TROPICAL DISEASES BUREAU.

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## BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

(1) CARPANO (M.). **Note epizooziologiche sulle infezioni piroplasmiche degli equini in Italia.** [Equine Piroplasmosis in Italy.]—*Il Moderno Zooiatro.* 1915. Oct. 31. Vol. 26. No. 10. pp. 404–412.

Both Nuttalliasis and Babesiasis occur in Italy, but the former is the more common. Occasionally cases of mixed infection are encountered. It would appear that the diseases follow a more benign course in the northern part of the peninsula than in the middle and southern parts, and cases are more frequently seen on low-lying uncultivated land than elsewhere.

According to the author's observations *Nuttallia equi* is transmitted by *Rhipicephalus bursa*, and *Babesia caballi* by *Margaropus annulatus*. The former of these passes the larval and nymphal stages on one host, and transfers itself to another for the adult stage. Ticks may become infected from the first host, and hand on the infection to the second. In the case of *Margaropus annulatus*, on the other hand, all the stages from larva to adult are passed on the same host, and consequently the parasite is handed on to the next animal by ticks hatched out from eggs deposited by an infected female.

Cases of the diseases may arise either as primary attacks or as relapses. The former generally occur during the spring or early summer, but the latter may be observed at all seasons. When a susceptible horse is introduced into an infected area, the period elapsing before the disease makes its appearance is generally 10–20 days. Relapses may occur within a short time after the primary attack, or there may be an interval of some years. They are not as a rule very serious, and seldom terminate fatally.

In apparently recovered animals *Nuttallia equi* persists in the blood for long periods, and should the infected animals become the subject of any debilitating condition a relapse is likely to occur. During the period of latent infection the parasite is said to be present in the blood in a form which resembles Anaplasma.

The immunity conferred by an attack or by experimental infection is not an absolute immunity, and it is strictly specific according to the type of parasite responsible for the primary infection.

In the ass and the mule only parasites of the Nuttallia type have been found.

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(2) Velu (H.) & Eyraud (A.). **Observations sur diverses formes de Piroplasmes, rencontrées sur des bovins indigènes de la Chaouïa.** [The Various Forms of Piroplasms found in Indigenous Cattle at Chaouia.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 643–646.

On a farm about 25 miles from Casablanca one of the authors saw two animals showing the following symptoms: Loss of appetite and suppression of rumination, pronounced thirst, pale mucous membranes, red urine, diarrhoea, the blood pale in colour and watery. There were numbers of ticks in the ears and the perineal region. One animal had already died after showing a similar train of symptoms.

Although piroplasmosis had only been discovered previously in imported animals, the condition of the animals raised the suspicion that they might be affected.

In blood taken from one of the animals a few hours before death 52 per cent. of the blood corpuscles were found to contain parasites. They were present in the form of long and short rods, comma-shaped organisms, oval, rounded, and amoeboid forms. In many cases a number of parasites were present in the same corpuscle, the largest number seen being five. The great majority of the parasites were very small.

In the blood of another animal, which died a few hours later, the number of parasites found was almost the same as in the first case. In two animals shortly after the onset of symptoms, the percentage of corpuscles invaded was about 30, and it was only exceptionally that more than one parasite was found in a single cell.

The small number of observations that the authors were able to make does not warrant any very definite conclusions. They specially point out that twin pear-forms were very scantily present.

(3) Crawley (H.). **Note on the Stage of *Piroplasma bigeminum* which occurs in the Cattle Tick, *Margaropus annulatus*.**—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 87–92. With 4 text-figs.

The parasite described in this paper was found in some ticks which had been used as controls in some dipping experiments.

They were removed from the cattle, immersed in water, dried, and placed in Petri dishes. Ordinarily such treatment does not cause any unusual behaviour on the part of the tick, but on this occasion a high mortality was observed in certain lots, and microscopic examination of some of them revealed the parasite described in this paper.

The parasites were cigar-shaped, and varied somewhat in length and width. The mean length of 50 specimens taken at random was about 11 microns. The cytoplasm of each was finely alveolar. There was a central vesicular nucleus with a large rounded karyosome. At the more rounded end of the body there was a kind of cap which varied somewhat in appearance in different specimens. In some cases it was rather like a crown with a minute pointed process arising from the central part, and in other cases it was like a narrow shell fitting over the extremity of the parasite. In some specimens the cap appeared to be rather denser and more homogeneous than the rest of the cell.

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Analogy is drawn between these parasites and those found by CHRISTOPHERS in *R. sanguineus*, which he considered to be a stage of *P. canis*. Reference is also made to the observations of KOCH, NUTTALL, GRAHAM-SMITH, and MINCHIN regarding the occurrence of similar forms in ticks obtained from animals infected with Piroplasmosis. Whereas some of these authors observed forms other than the club-shaped or cigar-shaped parasites similar to those referred to in this paper, the present author has been able to recognise these forms only.

Parasites of the same kind have been found to be scantily present in eggs from infected ticks, but none have been discovered in crushed seed ticks.

In addition to the gregarinoid parasite a spirochaete was also found. This parasite has not previously been reported in the United States, and it is suggested that it is identical with *S. theileri*.

No experimental evidence was forthcoming that the cigar-shaped parasite was actually a stage of *P. bigeminum*.

(4) PORTER (Annie). **On Anaplasma-like Bodies in the Blood of Vertebrates.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 561–568. With 10 text-figs.

The summary of this short paper is as follows:—

"Anaplasmata may occur in healthy and in anaemic vertebrate blood. The structures, also called marginal points and peripheral coccus-like bodies, are probably of diverse origin. It is doubtful if they are organismal in nature.

"Anaplasmata have been found by me in warm and cold-blooded vertebrates, wherein conditions such as herpetomoniasis and anaemia occurred. Some of the bodies originate from the nucleus of the erythrocyte or erythroblast, under the influence of haemolysis.

"The Anaplasma-like bodies were basophilic, apparently composed of chromatin or of a substance giving a similar staining reaction, and were homogeneous in structure. They varied from 0·3$\mu$ to 2·0$\mu$ in diameter, often being about 0·5$\mu$. Binary and multiple forms, which might be interpreted as phases of division, were seen."

(5) WILLIAMS (A. J.). **Report of the Treatment of Nuttalliosis or Biliary Fever in Army Horses at Secunderabad, Deccan, India.**—Army Headquarters, India. Quartermaster General's Branch, Simla, 1914. Calcutta: Superintendent Government Printing. pp. 1–6. With 1 fig. & 8 charts.

The characteristic symptoms of the disease are: Sudden onset, dullness, loss of appetite, yellow to orange discolouration of the mucous membranes, the presence of petechiae which are red at first and subsequently become purple, and often increasing in size and coalescing to form large blotches on the mucous membranes. The initial temperature may be as high as 108° F., and in severe cases there is marked prostration. Remissions occur about every third day, though the temperature never rises so high as at the onset of the disease.

There is rarely observed any haemoglobinuria during the course of an attack, but in a few cases it has been noticed after the lapse of some months.

If the cases are recognised and put under treatment promptly, complications such as acute congestions of the lungs, enteritis, etc., do not occur. Where the disease is known to exist, it is of the utmost importance that any horse showing signs of dullness and loss of appetite should be placed under careful observation and its temperature taken. The rapidity with which an affected horse is placed under treatment is of the greatest importance.

As the evidence in India points to the disease being spread by flies and mosquitoes, isolation must be promptly effected.

When ticks are found in stables they must be traced to their source and their further introduction prevented. They should be eradicated from the stables by the constant use of the blow lamp. as they penetrate into cracks in the walls and ordinary disinfectants, do not reach them.

Treatment:—Quinine sulphate given in two dram doses twice or three times a day together with 4 to 8 ounce doses of magnesium sulphate to regulate the bowels has not been found to be successful. In some cases the disease was controlled for a few days, but remissions generally occurred with considerable loss of condition. Good results were obtained with half-dram quinine acid hydrobromide; remissions generally occurred, but the animals were fit for duty in about a fortnight after the administration of a second dose.

The same drug in one dram doses yielded even better results.

Trypanblue has given excellent results, the temperature falling to normal within three days.

In some cases the action of trypanblue is more marked than that of quinine; this has been noticed in cases where examination of the blood showed no parasites but the presence of marginal dots suggesting anaplasmosis, and in these cases the disease is usually a severe form of biliary fever.

In some cases in which the quinine acid hydrobromide failed to arrest the remissions it was followed by trypanblue with good results.

In two cases which did not improve under treatment with trypanblue this drug was followed by the quinine salt and good results were obtained.

In all these cases magnesium sulphate was given as necessary.

Large doses of arsenic appeared to be entirely without effect upon the parasite.

In cases complicated by congestion of the lungs great relief was afforded by the intravenous injection of one or two pints of normal saline solution after venesection.

During convalescence the animals were given five grains of arsenic and one dram of sulphate of iron in bolus twice daily.

The after-effects of quinine injections.—When quinine acid hydrobromide, or quinine bi-hydrobromate (Howard's), in half to one dram doses in an ounce of water is used, staggering usually occurs immediately after the injection. These symptoms of syncope are most marked in animals with a very high temperature, in cases showing pronounced prostration, and in animals in poor condition. As a rule these symptoms pass off in from 10 to 20 minutes and no further symptoms occur, but cases should be kept under observation as occasionally toxic symptoms

appear a few hours after injection, the respirations are very accelerated, and the pulse very weak. In such cases one grain of strychnine given hypodermically soon gives relief.

It would appear that in some cases the parasites are very small and difficult to stain. It has often been noticed that while the chromatin stains intensely the cytoplasm stains faintly. Some of the larger pear-shaped parasites are granular and show a distinct central vacuole.

It not infrequently happens that parasites cannot be found except with prolonged searching in the early stages, even when the temperature is as high as 105° to 107°. But at the second rise of temperature and in the later stages of the disease they are generally found with ease.

The parasite has been found in cases showing simple oedema with no rise of temperature, and no other symptom of the disease. One attack appears to confer immunity, and up to the time of writing no recurrence had been observed in any animal treated with quinine or trypanblue. The cases were to remain under observation to see whether they would contract the disease again the following year.

No cases have been seen in mules or in country-bred horses, and very few Arabs contract the infection.

In view of the fact that the disease can be transmitted by blood inoculation, it appears to be probable that it may be spread mechanically by biting flies, and the observations made appear to indicate that this is in reality the case.

Although ticks are capable of spreading the disease, in outbreaks at Deesa, Neemuch, Nasirabad, and Ambala no ticks could be found on the horses nor in the stables. The disease appears to be more prevalent during and after the rains.

The following flies and ticks have been found:—

Haematopota have been found in cantonments and near tanks in the vicinity. They attack horses vigorously.

*Tabanus rusticus* has been seen but not caught. This fly has been observed to bite infected horses.

Hippoboscidae have also been seen.

*Hyalomma aegyptium* has been found on horses and cattle. Its presence on horses and in stables is accounted for by the proximity of bullock sheds and the storing of bedding in the sheds.

Rhipicephalus has been found on dogs.

The only satisfactory method of eradicating ticks from a stable is the constant and thorough use of the blow lamp.

In his conclusions the author emphasises the necessity of an early diagnosis and prompt treatment. The intravenous injection of quinine acid hydrobromide gives excellent results. The appearance of pronounced symptoms of depression may be cut short by the injection of strychnine. As a rule quinine only produces toxic symptoms in animals with a very high temperature; if there is a slight rise of temperature only, no such symptoms are produced.

For large horses a single dose of one dram is as a rule sufficient. For small horses and ponies half that dose should be given. The dose need not be repeated unless there are persistent remissions of temperature, and the membranes remain icteric.

At the commencement of an outbreak quinine should be tried on some cases and trypanblue on others as the one appears to be more efficient in some cases than the other, possibly owing to some difference in the strain.

In a letter dated January 7th, 1916, accompanying the report, the author states that the yellow quinine acid hydrobromide, which can conveniently be put up in tablet form, is preferable as it is easily soluble.

Since the report was written 300 cases of the disease have been treated in this way with only 11 deaths.

(6) Macfie (J. W. Scott). **Babesiasis and Trypanosomiasis at Accra, Gold Coast, West Africa.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 457–494. With 2 plates & 6 charts.

In a tabular statement the author shows the results of the examination of a single film of blood taken from 100 of each of the following animals at the Accra slaughter-houses :—

Table I.—The results of the examination of 500 domestic animals for babesiasis.

| Host. | Number examined. | Number infected with piroplasms. | *B. bigemina.* | *T. mutans.* |
|---|---|---|---|---|
| Cattle, humped .. | 100 | 53 | 7 | 49 |
| Cattle, straight-backed .. | 100 | 40 | 3 | 38 |
| Sheep .. | 100 | 21 | — | 21 |
| Pigs .. .. | 100 | — | — | — |
| Goats .. | 100 | — | — | — |
| Totals .. | 500 | 114 | 10 | 108 |

The humped cattle are for the most part bred in the north and driven down to the markets. The straight-backed cattle are bred in the south. Some of the sheep come from a distance to Accra, but the goats and pigs are probably all bred locally.

The infections appeared to be benign, but as many of the animals were also infected with other parasites, and especially with trypanosomes, no definite conclusion could be arrived at with regard to this point. The blood of the animals showed a variety of abnormalities indicative of anaemia. No experimental investigations could be made as no certainly uninfected animals were available for the purpose.

The following species of ticks were collected from the cattle and sheep :—Boophilus, *Amblyomma variegatum*, and *Hyalomma aegyptium*.

The parasite which the author considered to be *B. bigemina* in the humped cattle appeared to be rather smaller than that found in the straight-backed animals, and its chromatin was rather less distinct.

The smaller parasite was generally present in small numbers only, but in a few cases the infection was a heavy one. Examination of preparations from the spleens of a number of infected animals failed to reveal any "blue bodies."

The author quotes MINCHIN with regard to the nomenclature of the genera Theileria and Babesia and concludes that, to avoid confusion, it is advisable to identify the small pleomorphic parasite as *Theileria* (*Babesia*) *mutans*.

Only a single case of canine babesiasis came under the author's notice at Accra, and that was in a dog which had been imported six weeks previously. At the time when the examination of the blood was made parasites were numerously present.

A piroplasm, *Nuttallia decumani*, n. sp., of the brown rat (*Mus decumanus*).—

This parasite was discovered in the blood of four rats. From two of these only a single film was obtained, and in both parasites were rare. Of the other two one was under observation for just over a month, and the other had been under observation for two or three months at the time of writing.

In the first of these animals the piroplasms made their appearance a few days after capture and increased up to the 15th day, by which time a considerable number were present in the blood. They then diminished, and by the 26th day had become very scanty again. They were still present in very small numbers on the 37th day when the rat was accidentally killed.

Parasites were detected in the blood of the other rat on the day of capture and they persisted for ten days.

Both of these rats showed Grahamella in their blood when captured, but these subsequently disappeared.

The majority of the piroplasms were amoeboid or ring-shaped, with an irregular mass of chromatin. In some of them there were two distinct masses of chromatin, and these in some of the ring-forms were placed opposite each other.

In addition to these forms there were found a few which appeared to have undergone division, as there were four lanceolate parasites arranged in the form of a cross. In each of these there were two dots of chromatin.

Subcutaneous inoculations of infected blood into white rats failed to transmit the infection, and a single attempt to infect a brown rat with ticks from an infected animal also failed.

*Trypanosomiasis.*—Three types of trypanosomes were found, and these the author identifies as *T. pecaudi* (*T. brucei* of Uganda; *T. ugandae*), *T. vivax*, and *T. pecorum* (*T. congolense*). These were found as shown in the following table in the smears used in the examinations for Babesia.

TABLE II.—Trypanosome infections found in animals killed at Accra slaughter-house.

| Host. | Number examined. | Number infected with trypano-somes. | Percentages infected with | | |
|---|---|---|---|---|---|
| | | | *T. vivax.* | *T. congolense.* | *T. pecaudi.* |
| Cattle, humped.. | 100 | 92 | 76 | 28 | 12 |
| Cattle, straight-backed .. | 100 | 18 | 14 | 6 | 1 |
| Sheep .. | 100 | 4 | 3 | 2 | — |
| Pigs .. | 100 | 5 | — | 5 | — |
| Goats .. | 100 | 1 | 1 | 1 | — |
| Totals .. | 500 | 120 | 18·8 | 8·4 | 2·6 |

As tsetse flies are only found very occasionally in Accra it is probable that the animals are infected before they reach the town. Tsetse flies are quite numerous within a few miles of Accra. The identification of the trypanosomes found was based almost exclusively upon the appearances presented by the parasites in a single preparation from each animal. A few experimental inoculations were made and these are said to have confirmed the diagnoses.

The author gives a number of charts showing the measurements of the parasites found and their percentage distribution.

A single case of trypanosomiasis was found in a dog. In the blood of this animal there were parasites of the *congolense* type, but they were too scanty to permit of any measurements being made. The animal was in an emaciated condition, was covered with sores and had a profuse watery discharge from the eyes. The infection terminated fatally.

The number of cases of equine trypanosomiasis encountered by the author and the types of trypanosomes found are shown in the following table.

TABLE VI.—Equine trypanosomiasis at Accra.

| Host. | Cases of trypano-somiasis. | Number infected with | | |
|---|---|---|---|---|
| | | *T. vivax.* | *T. congolense.* | *T. pecaudi.* |
| Horses .. | 13 | 2 | 4 | 7 |
| Mules .. | 5 | – | – | 5 |
| Donkeys .. | 1 | – | 1 | – |
| Totals .. | 19 | 2 | 5 | 12 |

In one case in a mare the trypanosome found was of the *congolense* type, but differed from that organism in certain respects.

The disease in this case lasted for two months, and during that time distinct plaques were seen on at least two occasions.

The trypanosome was a rather short stumpy one without free flagellum. The centrosome was generally placed at a little distance from the posterior extremity, while the nucleus was frequently placed quite close to the anterior end. On some days 50 per cent. of the trypanosomes showed this disposition of the nucleus. The body was homogeneous or finely reticulated, and the undulating membrane was very poorly developed. In the final stages of the disease many of the trypanosomes showed a deeply staining chromatin dot posterior to the nucleus.

From a table of the measurements of 300 trypanosomes it may be gathered that the maximum length was 17 microns, and the minimum 8, and that the peak of the curve of distribution occurred at 12. Three white rats, two guinea-pigs, and a rabbit were inoculated, but none of them became infected.

On account of the clinical aspect of the disease the author suggests that the trypanosome should be called *T. congolense* var. *equinum*.

Two cases of trypanosomiasis resembling acute dourine are described at some length. Both animals were mule mares and in both cases a polymorphic trypanosome of the *pecaudi* type was found.

In both cases the onset of the disease was extremely sudden—the animals had been at work in the morning—and in both cases there was depression, slight subcutaneous oedema, commencing paralysis of the hind quarters, and a watery discharge from the eyes and nose on the afternoon. In both cases also plaques about the size of a shilling appeared on the skin on the day following the onset of symptoms. The animals had to be destroyed on the third day of the disease as they were in a hopeless condition.

A single guinea-pig was inoculated from each, but only one became infected. Trypanosomes appeared in the blood on the seventh day and the guinea-pig died on the ninth. The strain was unfortunately lost through the death of the guinea-pig inoculated from the first one after an interval of two days only. The maximum and minimum lengths of the trypanosomes as shown by 25 parasites were 33 and 13 microns.

The author thinks that, though these animals could not have been infected during copulation, it is not impossible that the trypanosome was the same as the polymorphic strain of the dourine parasite which Yorke and Blacklock described as being indistinguishable from *T. rhodesiense* in 1913.

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## TRYPANOSOMIASIS.

(7) Sergent (Ed.), Sergent (Et.), Lhéritier (A.) & Béguet (M.). **Comparaison entre le *Trypanosoma soudanense* et le *Trypanosoma berberum*.** [Comparison between *T. soudanense* and *T. berberum*.] —*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 650–653. With 1 chart.

In this paper the authors give the details of some experiments designed to test the correctness of the view that they had previously expressed regarding the non-identity of the two parasites.

In 1907 LAVERAN on the ground of cross immunity experiments expressed the view that the two trypanosomes were identical, but in 1912 the authors working with LAVERAN'S strain of *T. soudanense* arrived at the opposite conclusion.

Subsequently LAVERAN again studied the question and reversed the cross-immunity experiments carried out in the first instance, but again came to the conclusion that the two trypanosomes are identical. Further cross immunity experiments by the present authors confirm their previous opinion that the two are distinct.

They therefore hold that the name *T. berberum* for the causal agent of debab should stand.

(8) VELU (H.). **La Trypanosomiase des chevaux du Maroc. (Étude clinique).** [Equine Trypanosomiasis in Morocco. (Clinical study.)] —*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 646–650. With 1 chart.

The symptoms presented by horses affected with trypanosomiasis in Morocco are in general those observed in other forms of chronic trypanosomiasis, with the notable exception that oedema is almost invariably absent. The onset of the disease is often unnoticed, but its course is marked by a progressive anaemia which shows at intervals acute phases.

The first symptom usually observed is the rapidity with which an animal becomes fatigued at work. While in the stable the animal is dull, and though the appetite is maintained it is capricious.

As the disease progresses the anaemia becomes more marked and there is increasing wasting and loss of condition. Together with this there is observed an uncertainty of gait, especially involving the hind legs. At this stage attacks of high fever occur. These are generally of short duration and more than two in a month are seldom observed. The temperature will run up three or even four degrees in a few hours. This elevation of temperature is accompanied by acute depression, difficulty of respiration, and acceleration of the pulse. These attacks may last from 12 hours to four or five days. After such an attack the animal returns to its former condition save that the anaemia and general cachexia are more pronounced. These attacks coincide with increases in the number of parasites present in the blood. It is also observed that while during the general course of the disease the visible mucous membranes are white or bluish, during the acute phases they become yellowish.

The disease is not invariably fatal, but when recovery takes place the period of convalescence is very protracted.

It is stated that in some cases there are pronounced symptoms of enteritis and jaundice. Only a relative value attaches to the presence of petechiae on the mucous membranes, as these are not infrequently seen in healthy horses in Morocco. In a few cases slight transient oedema has been observed, together with enlargement of the glands and lesions of an eczematous nature.

The blood is always pale and watery. The muscles are pale and infiltrated with serous liquid. The lymphatic glands are generally

enlarged and reddish in colour, and when an animal dies during an acute febrile attack there is marked enlargement of the spleen. The liver is frequently brownish in colour, and the intestine shows slight congestion.

Purely clinical diagnosis is a matter of some difficulty, but daily examination of the blood, especially when the temperature is elevated, enables one to establish a diagnosis with certainty.

(9) Laveran (A.). **L'infection par *Trypanosoma gambiense* chez un maki, un renard, un raton, deux loirs, un meriones et deux gerbilles.** [A Lemur, Fox, a Raccoon, Two Dormice, a Merione,* and Two Gerbils infected with *T. gambiense*.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 745–751.

In this paper the author gives details of inoculations with *T. gambiense* of animals that are not generally used in laboratories.

Of two lemurs one was inoculated subcutaneously with blood from a guinea-pig infected with *T. gambiense*, and the other with blood of a guinea-pig inoculated with *T. rhodesiense*. The former survived for 26 days, after having passed through a slight crisis about ten days after inoculation. The latter died on the sixteenth day, trypanosomes having been present in the blood in increasing numbers from the fifth day up to the day of death.

The fox survived until the 56th day. During the course of the infection there were several crises, and at the time of death trypanosomes were scantily present in the blood. Opacity of the cornea was first observed on the 32nd day. This however disappeared, again to become visible after an interval of a few days. At the time of death there was complete opacity of the cornea of both eyes, and trypanosomes were present in large numbers in the aqueous humour. Apart from this the only lesion found at the post-mortem was enlargement of the spleen.

In the raccoon the period of incubation was twelve days, and the duration of life 31 days. Prior to the appearance of the trypanosomes in the blood there was marked agglutination of the red corpuscles. There was one crisis during the course of the infection, and at the time of death parasites were scantily present in the blood.

In a dormouse that was inoculated intraperitoneally the period of incubation was three days, and death took place on the seventh day. Another dormouse which was inoculated subcutaneously lived until the 22nd day, the period of incubation having been seven days. In both cases the trypanosomes steadily increased in numbers in the blood up to the time of death.

The merione which was inoculated subcutaneously showed trypanosomes in its blood on the eighth day, and died on the 31st day. The course of the infection was marked by three crises, and at the time of death parasites were very scantily present in the blood.

In the gerbils inoculated subcutaneously and intraperitoneally the periods of incubation were nine and two days respectively, but death took place on the 19th day in both cases.

* Meriones: a genus of Muridae.

(10) Laveran (A.). **Diminution de virulence chez des trypanosomes ayant subi un grand nombre de passages par animaux de même espèce.** [The Diminution in Virulence of Trypanosomes that have been passed through a Long Series of Animals of the Same Species.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 109–117.

The author has frequently found that, when strains of trypanosomes are maintained by passing them from animal to animal of the same species for long periods, there is a tendency for them to lose virulence for that species to such an extent that not only is the period of incubation prolonged and the course of the disease lengthened but actual recovery may take place. In such cases there is a risk of losing the strain, and the best way of reviving the virulence is to transfer it to an animal of another species and maintain it in that species for a time before using it again for the inoculation of animals of the species originally employed.

In this paper details are given of a number of experiments with a strain of *T. congolense* and a strain of *T. gambiense* illustrating these points.

(11) Rodhain (J.). **Note sur les Trypanoses et les Piroplasmoses des grands animaux de l'Ouelié.** [Note on the Trypanosomiases and Piroplasmoses of Large Animals of the Ouellé District.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 95–109. With 1 text-fig.

In this paper the author describes parasites encountered in the north-eastern portion of the basin of the Congo.

Among 89 domestic cattle examined 13 were found to be infected with *T. congolense* and *T. cazalboui*. Of nine sheep one was found to be infected with *T. congolense*. The examination of the blood of nine Equidae and 21 kids was negative in every case.

These figures must not be taken as indicating the percentage of animals infected, as circumstances prevented the author from carrying out full investigations. It was practically only those animals which showed clinical evidence of infection that were examined.

It is remarkable that no dimorphic trypanosomes were found.

As wild animals form the reservoir from which the domesticated animals derive their infection, a certain number of these were also examined. Although blood from 50 animals belonging to twelve species was examined either between a slide and coverglass or in stained preparations, not a single one was found to harbour pathogenic trypanosomes. There is no doubt, however, that if it had been practicable to carry out systematic inoculations infected animals would have been detected.

The author draws special attention to the fact that in none of the districts where the game were examined was Glossina present in large numbers.

A trypanosome of the *ingens* type was found in the blood of one *Cephalophus dorsalis*.

Three species of Glossina, *G. palpalis*, *G. morsitans*, and *G. fusca*, are found in the Ouellé territory. The development of trypanosomes in the first two species is fairly well known, but little is known regarding their development in *G. fusca*. Six infected individuals of this species were found among 26 dissected. In four instances the multiplication of the parasites was limited to the proboscis. In two the multiplication was taking place in the intestine and the proboscis. In no case was there any invasion of the salivary glands.

In one case in which multiplication was going on in the proboscis only the process was complete, as metacyclical or salivary forms were found in the lumen of the tube.

In view of what is known regarding the development of trypanosomes of the *cazalboui* and of the *congolense* types in the other species of Glossina it would appear to be probable that *G. fusca* is capable of transmitting these species.

Bovine piroplasmoses.—

*Piroplasma bigeminum* has been found once only.

A parasite referred to as *Theileria mutans* appears to have a wide distribution in the Ouellé region. In order to exclude the possibility of this parasite being in reality *T. parva*, the author carried out a number of gland punctures, but failed to find any developmental forms of the parasite.

The author refers to the parasite under the name mentioned because of the morphological resemblance to *T. parva*. He has not been able to carry out any experimental inoculations with blood.

At Doungou, Renzi, and Amadis the author was struck by the poor development of many of the calves, and is inclined to attribute it to infection with piroplasms during very early life.

*Ovine piroplasmosis.*—The author confirms the occurrence of piroplasmosis in sheep and states that the disease appears to have a wide distribution.

Morphologically the parasite resembles *T. mutans* but differs from it in the almost complete absence of bacillary forms. In Romanowsky preparations the majority of the parasites appear rounded or oval, with a few comma-shaped forms. The chromatin is always marginal and solid-looking. In the young parasites it is in the form of a rounded mass, but in the ring-shaped parasites it is elongated and lies along the periphery of the ring.

Multiplication is generally by binary fission. In blood that is heavily invaded and in which multiplication is progressing rapidly cross-forms which have been described as typical of the genus Theileria may occur.

The author suggests the name *Theileria ovis* for this parasite. He has also constantly found in the red corpuscles of the infected sheep bodies resembling anaplasmata. He is not convinced as to their parasitic nature.

In transmission experiments from sheep to sheep these bodies have made their appearance in a rather irregular manner, before, simultaneously with, or after the appearance of the piroplasms. They are not constant in size, some measuring less than one micron in diameter and others being nearly twice this size. It is possible that these are two distinct structures. The larger ones are said to resemble nuclear remains.

Attempts to differentiate between *T. ovis* and the anaplasm (?) by means of trypanblue failed because the drug did not cause the complete disappearance of the piroplasm.

The lesions found in an animal killed for the purpose of post-mortem examination were as follows: There was marked emaciation, no bile staining of the tissues, petechiae in the subcutaneous connective tissue and at the apex of the heart, in the right ventricle and on the abdominal surface of the diaphragm. Slight oedema at the base of the lungs, spleen normal, liver enlarged and congested. Kidneys enlarged, capsule easily stripped. Traces of albumen in the urine. Cervical glands slightly engorged.

A few inoculation experiments were carried out, but no definite conclusions can be based on the results. They appear to indicate however, that young kids are susceptible to a slight extent, and that the inoculation of young lambs gives rise to a slight but chronic infection. Some of the negative results obtained with adult animals may possibly be explained on the hypothesis that immunity is acquired early in life.

The parasites persist in the blood for long periods, and any depression of the vitality of the animal is followed by an increase in their number.

In the course of his investigations the author has found two specimens of *Cobus defassa* infected with a piroplasm morphologically resembling the larger forms of *T. mutans*.

A single cross-bred dog of European origin was found to be infected with piroplasmosis. Examination of a number of native dogs failed to reveal a single case of infection.

The author gives the following list of flies which he captured and identified:—*Stomoxys calcitrans, Lyperosia minuta, Lyperosia punctigera, Glossina palpalis, G. morsitans, G. fusca, Chrysops silicea, C. distinctipennis, C. funebris,* and another species as yet unidentified, *Tabanus socius, T. secedens, T. ruficrus,* and *T. biguttatus,* and a series of other species not yet identified, including a large group of *Chrysozona* [*Haematopota*].

(12) Sergent (Ed.) & Lhéritier (A.). **Longue incubation ou latence d'infections à trypanosomes chez des chiens inoculés avec des virus provenant de chèvres.** [Long periods of Incubation or Latent Infection in Dogs inoculated with Virus derived from Goats.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 653–655.

The authors record the occurrence of a period of incubation of 2 months and 24 days in a dog inoculated with 100 cc. of blood from a goat infected with *T. marocanum,* while another inoculated with 110 cc. of blood from a similar source showed a period of incubation of 7 months and 11 days.

In a dog inoculated with 110 cc. of blood from a goat infected with *T. berberum* the period of incubation was exactly 8 months, while in another case it was 5 months and 13 days.

In these cases the course of the disease was exactly the same as in cases in which the period of incubation is of the ordinary length.

The blood of the dogs was examined thrice weekly.

(13) Macfie (J. W. Scott). **A Note on a Trypanosome of the Black Rat (*Epimys rattus*).**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 527-534. With 1 plate comprising 18 figs.

The trypanosome described in this paper was found in a black rat at Accra. The parasites were present in the blood in enormous numbers and, though of the *lewisi* type, they were found to be remarkably polymorphic. Two types of motility were observed, one when the parasites were progressing rapidly, which involved the whole of the body, and the other when the parasites were stationary, in which there was a rapid vibration of the anterior extremity of the body.

In a stained preparation measurements were made of a hundred consecutive individuals, and it was found that the length ranged from 15 to 48 microns, about half of them being upwards of 30 microns in length. The breadth varied from 2 to 6 microns, but the majority approximated to the smaller measurement. These measurements do not represent the maximum and minimum, as an individual measuring 52 microns, and one measuring 12 were found. Aggregations of dividing forms were also observed.

In all forms the posterior end of the body was long and tapering. The micronucleus was often oval or rod-shaped. The nucleus was placed well forward in the body. The undulating membrane was poorly developed, and there was a free portion to the flagellum. The body was generally quite free from granules. In some of the small forms the micronucleus was close to or even in front of the nucleus. In some of the largest specimens the posterior extremity of the body was prolonged into a whip-like lash and there were forms connecting these with the smaller types. In some of these large forms the length from the micronucleus to the posterior end of the body was as much as 24 microns.

The types of trypanosomes in the blood differed from day to day, and the author thinks that the parasite may be identical with *T. eburneense* described by Delanoë, although that author made no mention of the forms with the posterior prolongations.

Inoculation of a white rat and a guinea-pig failed to set up infection.

The author notes that Brown's* observations regarding a pathogenic strain of *T. lewisi* may possibly indicate that *T. eburneense* is a variety of *T. lewisi*.

(14) Mesnil (F.) & Blanchard (M.). **Sensibilité au sérum humain normal de Trypanosomes d'origine humaine.** [The Susceptibility of Trypanosomes of Human Origin to Normal Human Serum.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 81-85.

The authors give details of three experiments with regard to the action of human serum upon a strain of *T. gambiense*.

The results may be summarised as follows :—

Up to the present five strains of human trypanosomes have been studied in connection with the effects produced by human serum upon them. Two strains of *T. rhodesiense* have shown themselves to be

* See this *Bulletin* 1914, Sept. Vol. 2. No. 3. p. 130, & 1915, June. Vol. 3. No. 2. p. 48.

relatively susceptible to the action of human serum. A strain of *T. gambiense* studied by LAVERAN has proved itself to be resistant after having been maintained for 12 years in laboratory animals.

A strain of *T. gambiense* carried on by the authors when tested for the first time seven years after isolation from the human subject possessed a somewhat slight degree of susceptibility. During the last four years the degree of susceptibility has been slightly variable and at present it is about the same as that of *T. rhodesiense*.

The Lanfranchi strain about two years after its isolation possesses about the same degree of susceptibility as *T. rhodesiense* and the author's strain of *T. gambiense*.

(15) VAN DEN BRANDEN (F.). **Valeur moyenne de la durée de stérilisation sanguine chez les trypanosés par une dose de salvarsan, néosalvarsan, salvarsan cuprique et sel sodique du salvarsan cuprique.** [The Average Duration of the Sterility of the Blood of Persons infected with Trypanosomiasis produced by Salvarsan, Neosalvarsan, Copper Salvarsan, and the Sodium Salt of Copper Salvarsan.]—*Bull. Soc. Path. Exot.* 1916. Jan. Vol. 9. No. 1. pp. 13–15.

In tabular statements the author gives details of cases of trypanosomiasis treated by the drugs mentioned in the title of his paper. The cases were selected, the patients being in good condition, and the cerebro-spinal liquid normal.

Salvarsan.—A single dose of 0·01 g. per kilog. produced sterilisation of the blood for periods ranging from two to eight months.

Neosalvarsan in a dose of 0·013 g. per kilog. appeared to be effective for periods ranging from 4 to 22 months.

Copper salvarsan in a dose of 0·004 g. per kilog. cleared the blood of trypanosomes for periods ranging from 19 to 24 months.

The sodium salt of the foregoing in a dose of 0·0053 g. per kilog. was effective for periods ranging up to 12 months.

Four cases were treated with each drug, and it is pointed out that the periods in some cases may in reality be longer than stated as the patients have to be examined again.

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## LEISHMANIASIS.

(16) LAVERAN (A.). **Nouvelle contribution à l'étude des infections expérimentales de la souris par *Leishmania tropica*; un cas d'infection de la gerbille.** [Experimental Infection of the Mouse with *Leishmania tropica*, and a Case of Infection in the Gerbil.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 680–686.

The author gives the details of two white mice and a gerbil inoculated with *L. tropica*, in each of which there were lesions about the tibio-tarsal articulations. The two mice were inoculated intraperitoneally from another mouse, and the gerbil was inoculated intraperitoneally on seven occasions with cultures of the same parasite. In one of the mice there was a general infection, but in the other two animals the

lesions were limited to the scrotum and the skin. The parasites were present in large numbers in the serous exudate around the affected joints. In the gerbil there was also ulceration of the nose.

The author draws attention to the fact that the gerbil is common in areas where oriental boil is endemic, and suggests that although natural infection in this animal has never yet been recorded it may nevertheless prove to be the reservoir of the virus.

The infection is not invariably fatal in the mouse, as in one instance a mouse which had been inoculated 11 months previously and developed typical lesions in which the parasite was found, had apparently made a complete recovery four months before it was killed. At the post-mortem no trace of infection could be found.

Attempts to infect mice by ingestion and through the medium of fleas have constantly given negative results.

The author states that he has inoculated at different times 47 mice with *L. infantum* and *L. donovani*, but in no case have any lesions of the skin been observed.

(17) Townsend (C. H. T.). **The Insect Vector of Uta, a Peruvian Disease.**—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 67–73. With 4 text-figs.

The author's summary is as follows:—

"1. The disease known as *uta* occurring on the west face of the Andes in Peru, has been proved to be due to Leishmania.

"2. Two species of *Forcipomyia*, native to the western Andean region, appear to be proved to be capable of transmitting the Leishmania of Uta.

"3. It is highly probable that the various forms of Leishmaniasis thus far known are due to as many species of herpetomonads originally parasitic in the gut of the insect-carriers concerned, and that, with regard to the occurrence in man, these herpetomonads are as yet in the stages of parasitism ranging from habitually abnormal or frequent to mere accidental or infrequent."

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## UNDULANT FEVER.

(18) Nicolle (Ch.) & Gobert (E.). **Seconde enquête sur les chèvres laitières de Tunis au sujet de la fièvre méditerranéene.** [Second Inquiry into the Distribution of Mediterranean Fever among Milch Goats in Tunis.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 86–95.

The prohibition of the importation of goats from Malta into Tunis was followed by a marked diminution in the number of cases of Mediterranean fever in the human subject. In 1909, when the importation was stopped, 40 positive results were obtained in agglutination tests carried out with human serum at the Pasteur Institute at Tunis. This figure rose to 63 in 1911 and then rapidly fell, so that in 1914 only 7 positive results were obtained. In this connection it may be noted that only those cases were considered positive in which the agglutination titre was higher than 50.

The second enquiry into the disease was instituted because during 1915 the number of cases rose again to 40.

The investigations were carried out during the last six months of the year, and the following animals were examined: 2,354 goats, 14 donkeys, 9 cows, 7 dogs, 4 horses, and 2 cats.

Of the goats 1,277 were Maltese, and 1,044 Arab, the remainder being crosses.

The emulsion used in the agglutination tests was prepared from a strain of the organism isolated in 1909 from a Tunisian goat, and was the one used in the tests of human patients. The liquid used in the preparation of the emulsion was 7 per mille sodium fluoride. The emulsion contained 800 million bacteria per cc. Sodium fluoride is said to be valuable for the preparation of the emulsion as it preserves the chief reactions of the bacteria for long periods without sensible loss. The authors consider that emulsions prepared in this way are as sensitive as living cultures. Provided such an emulsion be kept at a low temperature, it may remain in a suitable condition for two years.

The experience gained by the authors in carrying out tests with human serum and the fluoride emulsion lead them to consider reactions below 1 in 20 as doubtful, reactions from 1 in 40 to 1 in 60 very suspicious, and those in higher dilutions as definitely positive.

Judging on this standard, the results obtained with the sera of the goats tested showed that of the total number (in round figures) 97 per cent. gave negative or doubtful reactions and 3 per cent. gave suspicious or positive reactions.

The figures for the Maltese goats alone show that 95 per cent. gave negative results and 5 per cent. suspicious or positive reactions.

The Arab and cross-bred goats yielded 99·3 per cent. negative results and 0·7 per cent. indicating probable infection.

The herds examined could be divided into four groups according to the locality in which they were placed, and on examining the figures given by the different groups it was found that the percentage of affected animals was markedly different in the various groups, those herds giving the higher percentages in which the larger number of Maltese goats was included. It was further found that the distribution of the infection was not even in any one group.

On comparing the distribution of the cases of the disease in the human subject with that of the cases in the goats it was found that the areas giving the greater numbers of cases coincided.

It is suggested that, although up to the present the disease has been found to be far more frequent in the Maltese than in native goats, the organism may in time acquire an exalted degree of virulence for the native animals or the cross-breds than for the Maltese animals.

The authors lay down regulations based upon those in operation in Malta for the control of the disease.

## RABIES.

(19) PHISALIX (Marie). **Les propriétés vaccinantes de la sécrétion cutanée muqueuse des Batraciens contre le virus rabique sont indépendantes de celles qu'elle possède contre sa propre action et contre celle du venin de Vipère aspic.** [The Vaccinating Properties of the Mucoid Cutaneous Secretion of Reptiles against the Virus of Rabies are Independent of those which it possesses against its own Virus and that of the Adder.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 730–731.

In experiments carried out by the author two axolotls or three brown frogs were placed in a vapour of ether and then washed with 15 cc. of distilled water. To the solution of the mucoid secretion thus obtained was added a little ether, and the mixture was placed in an ice chest for 48 hours. The liquid then had dissolved in it 10 mg. of dried adder venom. In sealed pipettes the liquid was heated in a water bath for 15 minutes at 75° C. The effect of this was to destroy the toxicity of the venom without altering its protective properties, nor those of the mucoid secretion.

The mixture was injected every second day in doses increasing from 1 to 5 cc. into the aural vein of rabbits. On the third day after the final injection the rabbits were inoculated intracranially with fixed virus. None of the animals developed rabies.

Subsequent inoculations with fixed virus at intervals of two, three, and four months showed that the immunity that had been acquired lasted for about two months.

It is pointed out that the immunising substance or substances do not result from a chemical reaction between the components of the mixture, nor from the heating, as the same results can be obtained if the secretion and the venom are injected in succession whether heated or unheated.

Whereas the mucus from the skin of the adder is both toxic and protective against its own action and protective against that of the salamander, that of the frog possesses neither of these properties, but is nevertheless protective against the virus of rabies. The conclusion must therefore be drawn that the substance present in the mucoid secretions of reptiles which immunises against the venoms is not the substance which immunises against rabies.

This secretion is also interesting from the fact that it is capable of developing physiological properties without undergoing any physical change. In *Proteus anguinus* and *Dactylethra laevis* it is innocuous, and justifies the comparison that has been made between it and the sweat of mammals. In *Rana temporaria* it exhibits powers of producing inflammatory conditions. In *Rana esculenta*, *Alytes obstetricans*, *Salamandra maculosa*, and *Siredon mexicanus* it is clearly toxic. It is only protective in its action against the toxic mucus and venom of *Vipera aspis* in *Siren lacertina*. In *Rana temporaria*, where it is neither toxic nor protective, it possesses the power of protecting against rabies.

(20) Zell (C. A.). **Rabies, Diagnosis and Treatment.**—*Amer. Jl. Vet. Med.* 1915. Nov. Vol. 10. No. 11. pp. 835–836 and 887–890.

The author has found that the complement fixation test can be used for the diagnosis of rabies if the antigen be prepared from the submaxillary glands of rabid dogs. The antigen is prepared by excising the glands, mincing them, and placing them in distilled water under a vacuum of 28 inches for at least an hour. The turbid liquid which is obtained is filtered through a Berkefeld filter. This antigen deteriorates rapidly, and it was found that an alcoholic extract made according to the Wassermann technique could be used equally well. In experimentally infected animals positive results were obtained several days before any symptoms were shown, the diagnosis being confirmed by the discovery of Negri bodies.

On one occasion the author's attention was drawn to a case of rabies in a horse in a barn where fifty other horses were stalled. The animal was too violent to permit any blood being taken, but blood was obtained from all the other horses and five gave positive reactions. The team-mate of the horse killed, the team stalled next to it, and two other horses known to have been bitten by the rabid horse gave positive results. These animals were treated and remained healthy.

With regard to the Pasteur treatment, the author's observations lead him to the conclusion that no antibodies can be demonstrated in the blood until three weeks after the completion of the treatment. This explains the occasional deaths occurring in people bitten about the face and neck.

The author has produced an immune serum by hyperimmunisation against street virus. A number of guinea-pigs were treated with immune serum on three occasions. They were then inoculated after an interval of a week with virus, some being done subdurally, some intramuscularly, and some into the anterior chamber of the eye. The first group nearly all died of rabies, while the majority of the remainder proved to be immune.

Guinea-pigs inoculated with rabies and then given injections of serum died if the interval elapsing between the inoculation with virus and the administration of serum was more than two days. The results obtained when the virus and serum were mixed were very similar to those obtained when the virus was given after the serum.

The five horses referred to above which yielded positive results to the complement fixation test were treated with the author's protective serum.

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## PROTOZOA.

(21) Macfie (J. W. Scott). **A Case of Dysentery in a Monkey, in which Amoebae and Spirochaetes were found.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 507–512. With 1 plate comprising 12 figs.

The monkey referred to in this paper was one infected with a strain of human trypanosome which was sent to the author at Accra. The animal died on the 65th day after inoculation and at the post-mortem

examination, apart from general emaciation and anaemia, the most marked lesions were severe ulceration of the large intestine and enlargement of the spleen. The lymphatic glands were not enlarged, and the monkey had shown no symptoms of trypanosomiasis during life.

In preparations from the contents of the large intestine numerous amoebae were found. The organisms in stained preparations measured from 12 to 30 microns in diameter, but the great majority approximated to the smaller measurement. Some of the larger ones contained a number of red blood corpuscles. Numerous cysts were seen which possessed a thick wall and contained a single large vacuole. In the narrow band of cytoplasm a number of faintly stained nuclei could be detected.

In addition to these amoebae immense numbers of spirochaetes were present in the contents of the large intestine. They ranged from 4 to 7 microns in length, were very slender, and had pointed extremities. Few of the parasites showed more than two coils. The author does not think that the spirochaete was pathogenic and draws attention to the fact that it very closely resembled *S. eurygyrata*, which has been found in the faeces of apparently healthy people.

(22) Scott (J. W.). **Some Notes and Experiments on *Sarcocystis tenella*, Railliet.**—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 20–24.

It has been suggested by Darling that "the sarcosporidia may be varieties of Neosporidia of invertebrates which have invaded the muscular tissue of a host where they cannot complete their development and from which they cannot escape." The author of the present paper has made some observations which tend to favour a similar view, but of this he has not as yet obtained any experimental evidence.

It would appear that the range sheep of Wyoming are infected with the parasite to an extent ranging from about 70 to 100 per cent. No parasites in the Balbiana stage have been seen. An experiment in which five young lambs were fed with pieces of heart muscle containing the parasite yielded an entirely negative result, and control lambs kept under the same conditions were also found to be free from infection at the time of slaughter.

In view of the suggestions that have been put forward by various authors that the parasite must have an intermediate host, the author carried out an experiment to test whether the parasite might be liberated by digestion in a carnivorous animal and thus rendered capable of infecting fresh animals.

A dog was fed twice with heavily infected heart muscle from sheep, and after a few days when the grass upon which the cage stood was well covered with faeces two lambs were placed in the cage where they remained 33 hours. After an interval of about three weeks a further pair of lambs were placed in the cage and left for 24 hours. None of these became infected.

In another experiment two groups of animals were kept respectively upon a pasture that was partly swampy and partly dry and one that was very dry. Infected muscle was scattered over both. When the lambs were killed 55 per cent. of those on the swampy ground were found to be infected, and 21 per cent. of those on the dry pasture.

It is pointed out, however, that these infections were probably contracted naturally, as the feeding of infected muscle direct to animals failed to cause infection.

If the view be taken that the presence of sarcosporidia in sheep is more or less accidental, the difference in the percentage of animals infected upon the two pastures may be explained in another way. The conditions in the pasture that was partly swampy favoured the occurrence of various insects, and the possibility is suggested that the sheep might become infected in a more or less accidental manner by ingesting either the insects which are the hosts of the parasite or their droppings.

This explanation favours DARLING'S view that the sheep is not the definitive host of the parasite.

(23) RODHAIN (J.). **Quelques hématozoaires de petits mammifères de l'Uele (Ouellé), Congo Belge.** [Some Haematozoa of Small Mammals at Uele, Belgian Congo.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 726–729. With 3 text-figs.

*Trypanosoma dendromysi* n. sp.—This parasite was found in the blood of a climbing mouse (*souris grimpeuse*) which has not yet been identified, but is fairly common at Aba on the border of the Mongalla district. Five out of six mice examined were found to be infected.

In the fresh state the parasite, which is of moderate size, executes slow translatory movements which allow of a fairly close study of the changes of shape shown by it during the process.

The nucleus, which is oval or rounded, is situated in the anterior third of the body. The blepharoplast is very small and is marginally placed at a little distance from the posterior end. The undulating membrane is narrow and is bordered by a flagellum of which about one third is "free." The body contains no granules, but sometimes shows one or more vacuoles. The length of the parasite ranges from 30 to 33 microns and the width from 4 to 5. The free portion of the flagellum measures about 10 microns.

The parasites were always very scanty in the blood. Intraperitoneal inoculation of a guinea-pig and a young savannah mouse failed to cause infection in either.

Haemogregarine of *Cricetomys gambianus*.—The parasite found in the red corpuscles of this animal closely resembles *Haemogregarina balfouri*.

The invaded cells become elongated and pale in colour. In the cells the parasites appear as vermicules with rounded ends, and are sometimes slightly curved. They measure about 10 microns in length and rather less than 4 in width. The nucleus, which is generally placed towards one end, occupies about two-thirds of the body.

Grahamella was also present in the blood of the infected rats.

Plasmodium of *Epomophorus franqueti*.—The author has found male and female forms of a plasmodium in the blood of four flying foxes, and diagrams of these are given.

(24) Fantham (H. B.) & Porter (Annie). **Some Experimental Researches on Induced Herpetomoniasis in Birds.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 543–558. With 1 plate comprising 40 figs.

The authors record the successful infection of birds with *Herpetomonas jaculum* from the water scorpion, and *H. culicis* from *Culex pipiens*.

The birds used were canaries, sparrows, and martins. In the feeding experiments the birds were fed either with the entire insects or with their alimentary canals only. The insects used—*Nepa cinerea* and *Culex pipiens*—were obtained in the neighbourhood of Cambridge.

A canary fed with material containing *H. jaculum* died on the 51st day. A film of blood made on the 21st day showed elongating post-flagellate forms of the parasite. Parasites were found a fortnight later when the bird showed evidence of being ill. There were also symptoms of illness on the day of death. During the course of the experiment the bird's weight fell from 26 g. to 10·2 g.

Preparations made from the organs showed that the liver contained leishmaniform bodies, a few elongating forms and flagellate forms in very small numbers. Leishmaniform types and developing forms were found in spleen, heart, lungs, and kidneys. Although the supra-renal bodies were very firm they showed no parasites.

An experiment in which a sparrow was fed with *Culex pipiens* terminated with the death of the bird on the 9th day. In this case also there was a generalised infection with *H. culicis*, but no parasites were found in the blood or in the intestine. Examination of the blood 14 hours before death occurred revealed a single organism in the process of elongating.

A small number of other experiments are briefly recorded in which the results obtained were similar to those referred to.

In a single inoculation experiment the bird, an adult martin, died after two days. No evidence of infection could be detected.

It is noted that in the more chronic infections the leishmaniform parasites predominated, while in the acute cases the flagellate forms were more numerously present, but that the experiments are as yet too few in number to warrant any general conclusions being drawn with regard to this.

*H. jaculum* in the non-flagellate forms is oval, and shows a nucleus and a well marked blepharoplast. The flagellate form is produced by a process of elongation, which is often preceded by division of the nucleus and blepharoplast, and the development of the flagellum. When need arises for a new host the flagellum is absorbed, the body becomes concentrated, and a thin cyst wall is produced. This form of the parasite is adapted to existence outside the host. When ingested by a new host the leishmaniform parasite is again produced.

In the experimentally infected canary the non-flagellate forms were from 4 to 6·6 microns in length by 2 to 5 in breadth. They were generally found singly. Dividing forms of the parasite at this stage were not numerous. In the flagellate stage the parasites resembled those present in the insect, but they did not attain so great a length.

The life-cycle of *H. culicis* is similar to that of the foregoing parasite, In the non-flagellate stage the parasites are about the same size.

although a few larger forms were encountered in *H. culicis* than in *H. jaculum*, and various stages of division were also found. The body of the flagellate forms ranged from 11 to 16 microns in length, and the flagellum was often about the same length. The parasites varied in width from 8·5 to 3·6 microns.

In all cases the parasites were far more numerous in the internal organs than in the circulating blood.

Among the general conclusions drawn it is stated that the various species of Leishmania are probably insect herpetomonads usually perpetuating the non-flagellate stage which is the more resistant, and a summary of the evidence tending towards this conclusion is given.

(25) Weidman (F. D.). *Coccidium bigeminum* **Stiles in Swift Foxes (Habitat Western U.S.)**—*Jl. Comp. Path. & Therapeut.* 1915. Dec. Vol. 28. No. 4. pp. 320–323. With 3 text-figs.

This parasite was found in two swift foxes, both of which were suffering from diarrhoea. One of the animals was passing large numbers of oocysts and the infection terminated fatally. In the case of the other animal the parasites were present in the faeces in small numbers only, and spontaneous recovery took place.

In fresh faeces double-contoured cysts with one or two spores may be found. Some of them are nearly spherical, measuring about 30 microns in each diameter. Others may be as long as 40 microns.

In faeces diluted with tap water and kept under observation continuously it was found that the single-spore forms divide by a process of constriction in from four to six hours. Within 24 hours each spore acquired a double-contoured envelope and contained four banana-shaped sporozoites and a granular residual body. This subsequently became hyaline.

Post-mortem examination revealed extensive haemorrhagic ulceration of the small and large intestines. The ulcers extended down to the muscularis mucosae. No parasites were found in the epithelial cells, but two or three naked protozoa measuring from 15 to 21 microns in their long diameter were found on the margins of ulcers. Double-contoured forms were also found on the surface of the mucous membrane.

The parasites observed in these animals appear to be larger than those previously described as occurring in the dog and the cat, and the author therefore suggests the name *canivelocis* for this variety. Although parasites of this species are not generally credited with possessing pathogenic properties, it would appear that in one of these cases they were responsible for death.

(26) Minchin (E. A.). **Remarks on the Nature and Significance of the so-called "Infective Granules" of Protozoa.**—*Ann. Inst. Past.* 1915. Nov. Vol. 29. No. 11. pp. 537–544. With 2 text-figs.

The author points out that the term "granule" used by Fry and Ranken and other authors for small bodies extruded by protozoa is in reality a misnomer. The particles are not cell-granules, but endogenous buds which when complete have the morphological and

cytological value of true cells. To establish this interpretation the author points out that many examples of endogenous budding are known among the protozoa, and special reference is made to the process occurring in an amoeba described by LISTON and MARTIN. The processes observed in this organism are compared with those described by FRY and RANKEN as occurring in trypanosomes.

In LISTON and MARTIN'S observations the amoebae were seen to extrude tiny buds from their cytoplasm which moved away and subsequently grew to the size of the parent organism. In fixed preparations numerous chromidial grains could be seen in the cytoplasm, and in the process of bud-formation a quantity of cytoplasm became separated off round a group of these grains which became clumped in the centre, the whole structure being then extruded. The principal nucleus of the organism took no part in this process of reproduction. Several such buds could be seen in a single amoeba.

In the corresponding process in the trypanosomes a small group of chromatin grains are extruded by the trophonucleus. These pass to the surface and are cast out. As they increase in size the differentiation of the trophonucleus and the kinetonucleus becomes apparent. Later a flagellum grows out from the neighbourhood of the kinetonucleus, and the organism develops into a trypanosome. The apparent absence of any cytoplasm in the buds formed by trypanosomes is explained as being a defect of the Romanowsky method of staining.

The author concludes that "infective granule" is a misleading term and that it should be replaced by "endogenous bud-formation."

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## HELMINTHS.

(27) WEIDMAN (F. D.). **The Distribution of Uncinaria among the Lower Animals.**—*Jl. Comp. Path. & Therapeut.* 1915. Dec. Vol. 28. No. 4. pp. 323–326.

During the past thirteen years fourteen cases of uncinariasis have been found in animals autopsied at the Zoological Gardens, Philadelphia. The tabular statement on following page shows the distribution of these parasites.

It is seen that seven of the cats came from districts where hookworm disease occurs.

The paper contains a short summary of the previously recorded cases of uncinariasis in animals.

(28) LINTON (E.). **Cestode Cysts from Muskrat.**—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 46–47. With 1 text-fig.

In this short paper the author describes the occurrence of four cysts in a muskrat—three in the liver and one in the peritoneum—which proved on examination to be *Cysticercus fasciolaris.*

TABLE SHOWING INCIDENCE OF UNCINARIA. [WEIDMAN (F. D.).]

| Autopsy Number. | Year. | Name of Animal. | Habitat. | Number of Males. | Number of Females. |
|---|---|---|---|---|---|
| 919 | 1906 | Grey wolf | Western United States | 8 | 2 |
| 1001 | 1907 | Grey fox | Western United States | 34 | 33 |
| 1157 | 1907 | Jaguarundi | South America | 3 | 4 |
| 1715 | 1909 | Wild cat (*Felis ruffus*) | South Carolina | 1 | 1 |
| 2241 | 1911 | Arctic fox | Arctic regions | 5 | 3 |
| 2392 | 1911 | Wild cat (*Felis ruffus*) | South Carolina | 0 | 1 |
| 2644 | 1912 | Wild cat (*Felis ruffus*) | South Carolina | 7 | 13 |
| 3037 | 1913 | Sea lion | California | 56 | 42 |
| 3221 | 1914 | Swift fox | Western United States | 0 | 4 |
| 3293 | 1914 | Wild cat (*Felis ruffus texensis*) | North Mexico and Texas | 11 | 10 |
| 3297 | 1914 | Wild cat (*Felis ruffus texensis*) | North Mexico and Texas | 10 | 14 |
| 3298 | 1914 | Wild cat (*Felis ruffus texensis*) | North Mexico and Texas | 4 | 3 |
| 3306 | 1914 | Red fox | North America, Eastern United States | 1 | 1 |
| 3561 | 1915 | Wild cat (*Felis ruffus*) | South Carolina | 0 | 1 |

(29) Seurat (L.-G.). **Sur les premiers stades évolutifs des Spiroptères.** [The First Stages of Development of the Spiroptera.]—*C. R. Soc. Biol.* 1915. Nov. 19. Vol. 78. No. 17. pp. 561–565. With 5 text-figs.

In this paper the author traces the changes passed through by the larvae of certain Spiroptera in the intermediate host.

The coprophagous Coleoptera frequently contain in their body-cavities larval nematodes enclosed in capsules produced by a proliferation of the epithelium.

These are sometimes present in very large numbers. The larger capsules contain a larva 3 or 4 mm. in length, which is that of the Spiroptera of the dog. The smallest capsules contain one or more larvae which vary in length from ·9 to 1·7 mm. in length and are characterised by a long tubular buccal cavity and two asymmetrical cervical papillae. This parasite the author believes to be *Physocephalus sexalatus*, which is apparently the same as that imperfectly described by Linstow as *Spiroptera* (*Filaria*) *strigis*.

These two larvae closely resemble each other, and a special feature of the resemblance is the possession of a prominent ventral and dorsal lip to the mouth, and the termination of the tail in a rounded button furnished with points. They also possess two lateral cervical papillae which may be placed symmetrically or asymmetrically. They also show two asymmetrical papillae on the upper border of the lateral areas in the region of the intestine.

In addition to these encapsuled forms free larvae are found.

The eggs of the Spiroptera of the dog and of *Physocephalus sexalatus* hatched out on a hollow slide produce larvae about 130 microns in length, the anterior extremity of which is blunt and armed with a short projection for the purpose of perforating, and the tail is conical.

The larvae of the first stage are 420 microns in length and about one-tenth of that in thickness. The head is rounded and carries a short boring apparatus. The tail is short and bluntly conical. On the ventral surface about the anterior fourth of the length of the body there is a pear-shaped vesicle with an excretory pore. The larvae in this stage are of particular interest as they are on the point of undergoing their first moult.

The larvae of the second stage are likewise free in the abdominal cavity of their host and only become encapsuled after the second moult. A large and a smaller parasite have been found, which the author thinks are *Spirocerca sanguinolenta* and *Physocephalus sexalatus* respectively. The larva of the second stage of the latter parasite is relatively slender, the head is rounded and the tail rounded and quite smooth. The excretory pore opens about 77 microns from the anterior extremity at the summit of a slight cuticular elevation. The anus has a prominent posterior lip. The buccal cavity measures 28 microns, and the oesophagus is about one-third the length of the body. The rudimentary genital apparatus is represented by an ovoid undifferentiated cellular structure applied to the ventral face of the intestine about the mid-point of its length.

The larvae of *Ph. sexalatus* when they measure about 0·8 mm. have reached their maximum development and are ready to undergo their second moult. In the cephalic extremity the head of the larva of the

third stage can be seen with its two dorsal and ventral lips, and the narrow tabular buccal cavity. At the caudal extremity the truncated end with a rounded boss covered with spicules can be made out. The second-stage larva only undergoes a second moult after encapsulation.

The second-stage larva of *Sp. sanguinolenta* closely resembles that just described, but is larger, the buccal cavity is more spacious, its walls are thicker, and the nerve ring occupies a more posterior position.

(30) Leiper (R. T.). **Report on the Results of the Bilharzia Mission in Egypt, 1915. Part III.**—*Jl. Roy. Army Med. Corps.* 1915. Sept. Vol. 25. No. 3. pp. 253–267. With 3 plates & 5 text-figs.

In this portion of the report the author deals with the development in the intermediary host, the penetration of the definitive host, and the development of the parasite in the definitive host.

The life-cycle of the digenetic trematodes may be concisely expressed by the scheme which the author gives (see page 29).

In the case of Bilharzia the development in the intermediate host is as follows :—The miracidium gives rise to a sporocyst which in turn gives rise to daughter-sporocysts. These migrate into the digestive gland and grow rapidly, becoming elongated and ramifying throughout the organ, which becomes greatly atrophied.

The sporocysts are not provided with any alimentary canal and absorb their nutriment through their delicate wall. They are capable of executing wriggling movements. The cercariae, which develop in the interior of the sporocysts, make their escape through rents in the wall.

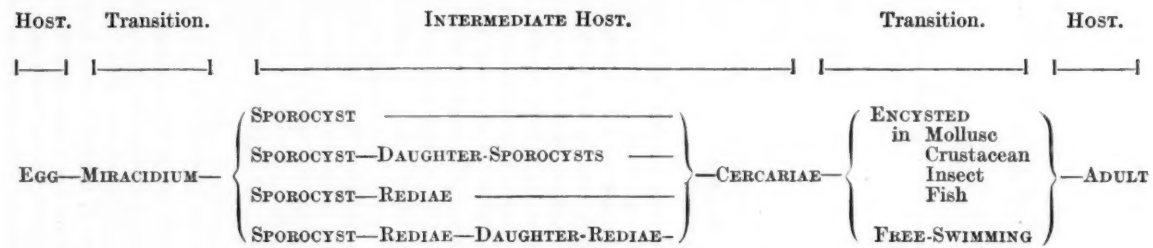
The cercaria comprises a body which is an undeveloped adult and a tail which is purely larval. They possess digestive, excretory, and genital systems and oral and ventral suckers. It is by these characters that the cercariae may be classified.

One of the most characteristic features of the Bilharzia cercariae is the presence of a tail which shows a terminal bifurcation. This feature is possessed by two divisions of distomes, the lophocerca and the furcocerca. Bilharzia belongs to the latter of these groups as it possesses a well developed ventral sucker.

The proof of actual penetration of the cercariae through the skin was furnished by suspending a young mouse in a test tube containing water full of cercariae for half an hour, and examining paraffin sections from the animal embedded whole. When the mouse was removed from the water only a few cercariae remained, and a large number of detached tails were found. The sections showed that the cercariae actually penetrated the skin, and did not enter the tissues by way of the hair follicles or pores. The warmth of the body seemed to be attractive to the cercariae, as very little evidence of penetration was obtained when a dead mouse was used.

After penetration of the definitive host there is no metamorphosis, development being simply a matter of growth and differentiation of organs and sexes. A plate gives illustrations of the various stages of development from the moment of penetration of the cercaria up to the complete development of the male and female, which requires a period of about two months.

LIFE-CYCLE OF A DIGENETIC TREMATODE. [LEIPER (R. T.).]



It is not yet certainly known by what path the parasite reaches the portal system, but it is definitely ascertained that all the cercariae do not reach the liver at the same time. It is probable that some pass direct into the blood stream, while others pass first through the lymphatic system.

(31) Ransom (B. H.) & Hall (M. C.). **The Life-History of** *Gongylonema scutatum.*—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 80–86.

The authors' summary is as follows :—

"The eggs of *Gongylonema scutatum* present in the faeces of sheep and cattle infested with the adult parasite, hatch out when swallowed by insects of various species.

"The larvae thus released from the eggs, pass into the body cavity and reach the final larval stage in about a month. In this stage the larva is coiled into a spiral and is enclosed in a capsule about half a millimeter in diameter. The length of the fully developed larva is about 2 mm. and the oesophagus equals about two-thirds the body length. The mouth, elongated dorso-ventrally, is surrounded by a flange-like chitinous border.

"Sheep fed upon insects containing these larvae became infested with *Gongylonema.* A hog fed upon croton bugs artificially infested by feeding with eggs of *Gongylonema* from cattle failed to become infected. A mouse, rabbit, and guinea-pig fed with *Gongylonema* larvae from beetles found in sheep manure, or from croton bugs artificially infested by feeding *Gongylonema* eggs from cattle, also failed to become infected. Failure to produce infestation in these various animals indicates that the *Gongylonema* of sheep and cattle (*G. scutatum*) is not transmissible to hogs, mice, rabbits, or guinea-pigs.

"*Gongylonema* larvae have been found in various species of dung beetles collected from sheep manure, namely, *Aphodius femoralis, A. granarius, A. fimentarius, A. coloradensis, A. vittatus, Onthophagus hecate,* and *O. pennsylvanicus.* They have been developed in various species of *Aphodius* and in croton bugs (*Ectobia germanica*) by feeding the eggs of the *Gongylonema scutatum* from cattle. The feeding of eggs of *Gongylonema* from the gullet of a hog (presumably *G. pulchrum*) to croton bugs also resulted in the development of encysted larvae.

"Under natural conditions the usual intermediate hosts of *Gonglyonema scutatum* are probably dung beetles of various species.

"The life history of *G. scutatum* is similar to that of *G. neoplasticum* of rats, mice, and other rodents, the intermediate stage of the latter having been found by Fibiger and Ditlevsen to develop in roaches (*Periplaneta americana, P. orientalis,* and *Ectobia germanica*) and in a beetle (*Tenebrio molitor*). It is also similar to that of another rat and mouse parasite, *Spiroptera obtusa,* whose intermediate host was found by Leuckart and Marchi to be the larva of a beetle (*Tenebrio molitor*)."

## BITING FLIES, ETC.

(32) Rodhain (J.) & Bequaert (J.). **Sur quelques Oestrides du Congo.** [The Oestridae of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 687–695.

In this paper the authors revise in the light of recent discoveries the classification of the African Oestrinae which they published in 1913*. In addition to the introduction of the new genus *Kirkioestrus* (*Kirkia* Gedoelst), they have included the *Cephenomyia* Latr. and the *Pharyngomyia* (Schiner).

(33) Rodhain (J.) & Bequaert (J.). **Sur quelques Oestrides du Congo.** [Some Oestridae of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 765-778.

Four species of Oestridae have been discovered in elephants in the Belgian Congo. Two of these occur in the stomach, one in the oesophagus, and one in the sole of the foot.

The species found in the foot is *Neocuterebra squamosa* Grunberg, and it is found in the adipose tissue of the sole, or partly in the thickened dermal layer. This species is very scarce and all attempts to obtain the mature insect have failed.

The larvae are oval in shape and biconvex. They are very slightly fattened from above to below. There are neither intermediate zones nor lateral prominences. The two cephalic segments are fused, making 11 segments in all. Both surfaces show a number of regularly arranged rounded or toothed chitinous scales. The pseudocephalon is retracted into the third segment and provided with two small buccal hooks, and two antennary papillae. The anal segment is very small, and completely retracted into a deep depression in the preceding segment. The posterior stigmatic plates are oval and enclosed in a deep hollow in the anal segment.

The parasite varies in length from 17 to 21 mm. and from 8 to 11 in width.

The oesophageal parasite is very common and belongs to the species *Pharyngoglobus africanus* Brauer. It is found attached to the wall of the oesophagus close to the cardia. The authors have been able to obtain pupae in fresh faeces, and attention is drawn to the fact that the larvae mature in the oesophagus and are passed through the intestine and pupate in the soil.

In the third stage they measure from 25 to 29 mm. in length and from 10 to 11 in width. The body is slightly flatter on its ventral than on its dorsal face, and the posterior extremity is about the same width as the anterior. The antennal swellings are widely separated at their bases and each is furnished with three ocelliform projections. The anal segment is rounded posteriorly and the stigmatic cavity is very deep. The latter is open to the exterior through a small aperture bounded by two lips which are in contact. The pre-anal swelling is well developed, but shows no transverse groove. There are numerous

* *Rev. Zoolog. Africa.* Vol. 2. No. 2. p. 182.

rings of spines, but there are no groups on the ventral surface. There are complete rings of spines which are composed of alternating large and small ones.

The anterior stigmata are well developed and appear as thickened chitinous knobs. The posterior stigmatic plates are semilunar in outline and show numerous false apertures.

In the second stage the larvae are scarcely different from those in the third stage except for their smaller size.

The pupae which the authors have been able to obtain from larvae evacuated naturally measured about 15 mm. by 8 mm. When viewed from below their outline was practically oval. The dorsal surface was markedly convex and slightly swollen behind the middle point. The ventral surface was almost flat.

From 20 to 21 days were required for the development of the nymph.

In a previous communication the authors included these parasites with the *Cephenomyia*, *Pharyngomyia*, and *Aulacephala*, but having had the opportunity of examining specimens of the first two they are now of the opinion that they should be grouped with the *Calliphorinae*.

Gastric larvae appear to be very common in elephants, and the authors have found two distinct types, types so different that they are almost inclined to place them in two separate genera.

One of the parasites found, of which the authors have been able to obtain the hitherto undescribed perfect insect, appears to be *Cobboldia loxodontis* Brauer.

Details are given of the characteristics of the male and female imagines, and attention is drawn to the fact that though they closely resemble *Cobboldia elephantis* there are certain points of difference serving to distinguish them.

The larvae in the third stage measure from 20 to 22 mm. in length by about 8 mm. at the widest part. The five anterior rings gradually taper to the cephalic extremity, but the posterior rings are more constant in size, with the exception of the last which is far narrower than the immediately preceding one.

The body is biconvex and there are no intermediate zones on either surface. On each side there are three deep longitudinal grooves between which on each ring from the second to the eleventh there is an upper and a lower prominence. On the second, third, and fourth segment there is often a third smaller projection.

As in the case of *C. elephantis* Steel there are no conical lateral swellings on the seventh to the eleventh segments.

The posterior stigmatic plates are placed very close together on the upper surface of the anal cavity so that they are scarcely visible from the exterior. They are oval in shape.

On the dorsal surface spines are present along the anterior borders of the segments only. On the ventral surface the segments show an increasing number of rows of spines to the sixth and seventh segments where there are four rows, and posterior to this they decrease in number again. On the sides of the body fusiform intermediate areas from the third to the eighth segment show groups of spines. There are two or three rows of small spines on the anal segment above the stigmatic plates, and the lower lip of the orifice shows above the conical prominences two swellings crowded with spines.

The duration of nymphosis is 19 to 20 days. The pupa closely resembles that of *Cobboldia chrysidiformis*, and differs only from it in details of the disposition of the spines, and the rather larger size.

*Cobboldia chrysidiformis* n. sp.

Full details are given of the male and female flies, and special attention is drawn to the fact that this fly presents an appearance so different from the other members of the genus that the authors were inclined at first to make a new genus for it. They bear a striking resemblance to Chrysudes family of the hymenoptera both in respect to their general form and their brilliant greenish-blue metallic lustre.

The larvae in the third stage are of a dirty white colour and measure from 14 to 15 mm. in length by about half that at the widest part.

On the lateral swellings from the eighth to the eleventh segment there are conical papilla-like projections, and on the seventh segment there may be a very small projection corresponding with these.

The two segments of the pseudo-cephalon resemble those of *C. loxodontis*, and, as in that parasite, the anal segment carries three pairs of conical papillae. The general arrangement of the spines is very similar to that of *C. loxodontis*, but the spines are far less numerous.

The colour of the pupae is a glistening brownish-black. The anal segment is completely retracted into the preceding one. The anterior stigmata appear as two brownish-yellow swellings mounted on a short peduncle. The swollen extremity is surrounded by a complete circle of twelve small papillae.

The pupae measure from 13 to 15 mm. in length by 5 in width.

The classification of the genus Cobboldia is discussed.

(34) Joyeux (Ch.). **Sur quelques Arthropodes récoltés en Haute-Guinée française.** [Some Arthropods collected in Upper French Guinea.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 656–659.

The larvae of *Amblyomma variegatum* are very numerous from November to February, and they attach themselves to man and animals. They commence to drop off at about the 12th hour, and continue to do so until the third day. The nymphs also attach themselves to man but to nothing like the same extent. The author has seen only one clear case of parasitism with the adults.

*Dermanyssus gallinae* and *D. hirudinis* are both common.

*Hippobosca maculata* Leach is common, and bites all species of domesticated animals, but the author has never observed it to bite man. The whitish pupa of this fly becomes black within 24 hours and hatching occurs in from 23 to 30 days.

Along the banks of the Niger and its tributaries the author has found both *G. morsitans* and *G. palpalis* in the proportion of two of the former to 52 of the latter.

The following mosquitoes have been obtained:—*Culiciomyia nebulosa, Culex duttoni, Pyretophorus costalis, Myzomyia funesta, Cyathomyia fusca, Stegomyia calopus, Toxorhynchites brevipalpis.*

Myiasis has been observed once in the human subject and seven times in animals, the latter cases being due to *Chrysomyia megacephala*. The female of this species lays about 90 eggs on the skin, and after an

interval of 18 to 24 hours, the larvae penetrate into the subcutaneous connective tissue and there complete their development. Necrosis of the skin results, and the adult larva drops to the ground, where it pupates.

In addition to the bovine animals already recorded by ROVERE as being attacked by this fly, the author has observed two cases in horses. The usual position of the lesions in cattle is about the mammary gland, and in the male about the scrotum, but the author has seen them in wounds of the dewlap of a zebu, and the base of the horn in an ox. In the horse the lesions are generally around the fetlock or near the frog.

*Cordylobia anthropophaga* is frequently a parasite of dogs and monkeys.

In one instance the author found a very severe infestation with *Gastrophilus nasalis* in the duodenum of a mule.

(35) NUTTALL (G. H. F.). **Ticks of the Belgian Congo and the Diseases they convey.**—*Bull. Entom. Research.* 1916. Feb. Vol. 6. No. 4. pp. 313–352. With 48 text-figs.

In this paper the following subjects are dealt with: The classification of ticks, together with a short illustrated account of the species occurring in the Congo; The general biology of ticks; The special biology of the Congo ticks and their relation to disease. The concluding pages give information on the following points: How to collect ticks and what to observe; How to raise ticks; and an Index to the Congo ticks and their hosts.

The following tabular statement regarding the ticks is included:—

INDEX TO CONGO TICKS AND THEIR HOSTS.

| | Hosts.† |
|---|---|
| *Amblyomma cohaerens*, Dönitz 1909 .. | cattle, *buffalo.* |
| * ,, *hebraeum*, Koch 1844 .. | *cattle, sheep, goat, antelope.* |
| ,, *marmoreum*, Koch 1844 .. | rhinoceros, Genetta, Chelonia, python. |
| ,, *pomposum*, Dönitz 1909 .. | *cattle, mule, antelope.* |
| ,, *splendidum*, Giebel 1877 .. | *cattle*, buffalo. |
| ,, *tholloni*, Neumann 1899 .. | *elephant*, horse, antelope. |
| ,, *trimaculatum*, Neumann 1908 .. .. .. | lizards. |
| ,, *variegatum* (Fabricius 1794) | *cattle*, sheep, rhinoceros. |
| *Aponomma exornatum*, Koch 1844 .. | reptiles. |
| ,, *laeve*, Neumann 1899 .. | reptiles. |
| **Boophilus decoloratus* (Koch 1844) .. | *cattle*, sheep, goat. |
| *Dermacentor circumguttatus*, Neumann 1897 .. .. .. | elephant. |
| ,, rhinocerotis (de Geer 1778) | rhinoceros. |
| **Haemaphysalis leachi* (Audouin 1827) .. | *Carnivora*, cattle, sheep, goat, horse. |
| ,, *parmata*, Neumann 1905 | cattle, goat, sheep, buffalo, antelope, dog, Potamochoerus. |
| ‡*Hyalomma aegyptium* (Linnaeus 1746) .. | *cattle, sheep*, etc., dog. |

* See note at end of Index.

INDEX TO CONGO TICKS—*cont.*

| | Hosts.† |
|---|---|
| *Ixodes rasus*, Neumann 1899 .. .. | cattle, dog, leopard, Hyrax. |
| ,, *rubicundus* var. *limbatus*, Neumann 1908 .. .. .. | sheep, goat. |
| **Ornithodorus moubata* (Murray 1877) .. | *man.* |
| *Rhipicentor bicornis*, Nuttall and Warburton 1908 .. .. .. .. | horse, goat. |
| **Rhipicephalus appendiculatus*, Neumann 1901 .. .. .. | *cattle, sheep, goat, horse.* |
| * ,, *capensis*, Koch 1844 .. | cattle, antelope, pig. |
| * ,, *evertsi*, Neumann 1897 .. | cattle, horse. |
| ,, *evertsi* var. *albigeniculatus*, Warburton 1915 (n. var.) | cattle. |
| ,, *falcatus*, Neumann 1908.. | cattle, goat, dog. |
| ,, *lunulatus*, Neumann 1907 | *cattle*, sheep, goat, antelope, dog. |
| * ,, *sanguineus* (Latreille 1804) | *dog*, sheep, goat. |
| * ,, *simus*, Koch 1844 .. | cattle. |
| ,, *supertritus*, Neumann 1907 | cattle. |
| ,, *tricuspis*, Dönitz 1906 .. | rabbit. |

*Denotes species which convey diseases and whose life-histories are described in the text.

†Names in italics are those of hosts from which we have received most specimens.

‡Life-history described in the text.

(36) BISHOPP (F. C.) & LAAKE (E. W.). **A Preliminary Statement regarding Wool Maggots of Sheep in the United States.**—*Jl. Economic Entomol.* 1915. Vol. 8. No. 5. pp. 466–474.

As yet the species of flies responsible for this injury to the wool in the United States have not been definitely ascertained, but it is believed that *Lucilia sericata* and *L. caesar* are responsible, at least in part.

In parts of Texas two types of injury to the wool are observed. The first of these occurs in ewes just after lambing, which takes place in March and April. In this case the infestation is confined to the rump. In the other type of injury the process starts about the base of the horns in rams, the infestation being favoured by the presence of small wounds in this situation, which are caused by fighting.

Formerly the flies appeared to blow only soiled wool, but during recent years they appear to have acquired the habit of attacking all classes of sheep, clean or otherwise.

In Texas the authors have found that the common black blow-fly is responsible for these attacks during the spring.

The infestations which occur in Texas during the late summer are probably due to *L. sericata.*

*Phormia regina*, the black blow-fly, is found throughout the United States, but its seasonal distribution varies according to the temperature. In the southern parts it is most plentiful in the spring, but is active through the winter except for a few days during the cold period. It disappears during the hot weather. In the more northern parts the season is during the summer.

The fly breeds almost exclusively in animal matter, especially if it is in a decaying condition, and it appears to be probable that it is the odour of soiled wool, particularly if blood be present, that attracts the flies to living sheep. It is observed that the flies do not feed on the droppings of herbivorous animals.

Hatching requires from 24 hours to 4 days under experimental conditions, but it is probable that the period is shorter with eggs deposited upon living animals. The larvae complete their development in from 4 to 76 days, and before pupation they generally penetrate into the ground to a depth of three or four inches. The pupal stage last for from three days to a month. The periods are shorter as the temperature rises, but excessively high temperatures appear to hinder breeding.

When caged without food adults have lived from two to eight days. With animal food they have lived for one to three months.

*Lucilia sericata* is observed throughout the Southern States except during the coldest periods. Reproduction does not take place during the winter even in the extreme south, the winter being passed in the larval or pupal stage in the ground. Attempts to keep adults through the winter in cages have not been successful.

While *P. regina* is found on the ranges, *L. sericata* is far more closely associated with human habitations. Garbage of all sorts, and especially damaged fruit, is a favourite food of the adult, but the authors have not succeeded in rearing larvae or even obtaining deposits of eggs on substances other than animal matter.

The adult does not live for more than three days in captivity when starved, and when fed the period of life does not exceed six weeks.

The interval between emergence of the adults to the commencement of egg laying varied from 4 to 21 days. As a rule rather less than 24 hours is the period required for hatching.

As measures for the repression of the condition it is suggested that carcases should be burnt, or if that be impracticable they should be buried. If they can be buried before they become blown a few inches of soil is sufficient to cover them, but if they are already blown they should be buried to a depth of two feet to prevent the flies from emerging.

The lambing should be done if practicable during the winter, and the flock should be divided into small lots and carefully watched. Every effort should be made to prevent scouring. Hornless breeds should be encouraged.

A hymenopterous parasite, probably *Nasonia brevicornis*, has been found to breed freely in the puparia of a number of carrion flies, and as the period required for the development is short and the reproductive capacity of this parasite is great, it may be looked upon as an important check to fly breeding.

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## MISCELLANEOUS.

(37) Weidman (F. D.). **An Arachnoid (*Pneumotuber macaci* Landois and Hoepke?) Parasitic in the Lungs of a Monkey (*Macacus rhesus*).**—*Jl. Comp. Path. & Therap.* 1915. Dec. Vol. 28. No. 4. pp. 326–330. With 1 text-fig.

In the lungs of a monkey dying from subacute enteritis the author found a number of nodules varying in size from 2 to 5 mm. in diameter. The smaller ones were firm, but the larger ones showed soft centres with indurated edges. In the fresh state they were pink or grey and

contained grey granular material. Under the microscope arachnoids were found in the centre of them. Sections showed that the centres of the lesions were composed of necrotic material surrounded by an ill-defined wall composed of mononuclears and fibroblasts.

From one of these lesions nine parasites were obtained. Eight of these appeared to be females, some of which were ovigerous. Embryos were visible within the eggs.

The full-grown parasites measured about 0·75 mm. in length. The legs terminated in claws.

A full description of the parasite is withheld until the author has had the opportunity of consulting the descriptions given by other authors of similar parasites found in the same situation.

(38) WEIDMAN (F. D.). *Pneumonyssus foxi*, **nov. sp. An Arachnoid Parasitic in the Lung of a Monkey** (*Macacus rhesus*).—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 37–45. With 1 plate comprising 10 figs.

For a short account of the occurrence of this parasite see above.

The females measured rather less than 1 mm. in length by nearly 0·5 mm. in width at the widest part, viz., just behind the posterior pair of legs. None of the internal organs could be made out, but in a few females an egg could be seen, and in some instances the outlines of a folded embryo in the interior of it.

The head is continuous with the body both dorsally and ventrally. There are no eyes. The rostrum projects slightly, is triangular in shape with a rounded apex, and shows on its dorsal surface a wide groove. The hypostome is quadrilateral and shows a slight median anterior marginal peak. A shallow furrow runs along this in which are placed 8 to 13 blunt teeth directed downwards and forwards. The mouth parts are retracted. Full details are given regarding the structure of the legs.

The first pair of legs has two arched dorsal claws, the extremities overhang or touch a pointed ventral projection. The second pair terminates in a short broad caroncle with two strong claws attached to its dorsum internally. The third pair terminates in a manner exactly similar to the second. The hooked caroncles and the hooks on the fourth pair of legs are more slender and elongated than on the preceding pairs.

The cuticle is soft and has an appearance resembling very fine morocco leather ; this is especially marked in certain areas.

The vulva lies ventrally in the middle of a transverse ridge joining the fourth coxae. It is longitudinal, fissural, and short, and is flanked by narrow plates. It appears to be continuous above with the posterior angle of a laterally elongated triangular opening. The intestines are indicated by two tortuous black lines which lie longitudinally close to the dorsal cuticle.

A single parasite judged to be a male from its smaller size was discovered. This parasite measured 0·55 by 0·25 mm. There was no vulval orifice, but a special anterior ventral orifice. Otherwise it was very similar in its general features to the females.

The genital orifice is a small circular orifice immediately behind the hypostome. From this a tube leads posteriorly for some distance just under the ventral cuticle.

A larval form was found which appeared to have escaped from a female, close to which it was lying, as a result of rupture of the latter during manipulation. This parasite possessed only six pairs of legs, and was about the same size as the male above referred to.

The parasite appears to be different from the four species occurring in the same situation already described. The classification of the parasite in the genus Pneumonyssus is only tentative, and it is pointed out that the position of the genital orifice of the male places the parasite close to, if not in, the Gamasidae.

(39) Healy (D. J.) & Gott (E. J.). **A Filterable Organism isolated from the Tissues of Cholera Hogs.**—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 124–127. With 1 plate.

The work reported in the present paper arose out of the discovery by Healy and Smith that an extract of mesenteric glands could be used as antigen in complement-fixation reactions. The evidence indicated that the antigen was specific. It is noted that in the original preparation the glands had to remain for at least eight days at 4° C. to allow the antigen to develop, and also that passage of the preparation through a Pasteur-Chamberland F filter removed it. The preparation of glands referred to was originally made in an attempt to isolate a filterable virus from them. Since in these experiments the extract was always passed through the filter immediately after the glands had been ground up with sand and the results were invariably negative, it occurred to Healy that the reason might be that the organisms were present in too small numbers, and that if the extract were allowed to stand at 4° C. to allow of a possible multiplication the subsequent filtration might not completely stop the organism.

The mesenteric glands of some infected pigs were dissected out with sterile precautions and ground up with sand. They then had added to them ten times their weight of 1 per cent. neutral glucose beef broth and were left at 4° C. for five days. During this period active fermentation occurred. The liquid was then passed through a reburnt, tested, sterile F filter, the period required being 40 minutes. The brilliant filtrate was divided between two Erlenmeyer flasks. One of these was placed in a Novy jar and the oxygen exhausted. The other was sealed with paraffin and placedin the air. Both flasks were kept at 4°C.

No growth developed in the flask in the Novy jar. In the other there was visible growth from the fourth day, which continued for about two weeks. This growth took the form of a very fine sediment which was easily disturbed by shaking. The flask which had originally been placed in the Novy jar when sealed with paraffin and placed in the air developed an exactly similar growth from the 7th day. This experiment was repeated three times with the same results.

The authors have found that the organism grows best at 37° C. in extract of mesenteric glands to which 5 per cent. glycerin has been added. Under these conditions there is visible growth after 24 hours and the maximum is reached in about three days. No growth takes place in the absence of oxygen, nor in any of the ordinary culture media. No subcultures have been obtained.

The original extract of the glands is slightly acid in reaction, and this acidity increases with incubation. No growth takes place if the medium be neutralised.

In hanging drop preparations it is seen that the organism is non-motile. It occurs in very small clumps showing many minute bright points. Individual organisms cannot be clearly distinguished.

Ordinary aniline dyes do not give good results, but under proper conditions good results are given by Giemsa.

A three-day culture grown at 37° C. was centrifuged and smears made of the deposit. These were allowed to become dry in the air, and were then fixed in methyl alcohol for an hour, rinsed in distilled water and again air-dried. They were stained with a warm solution of Giemsa containing 50 drops to 50 cc. and accurately neutralised. After staining the preparations were washed in distilled water, air-dried and mounted in xylol balsam. In such a preparation the organisms are clearly seen as minute lilac coloured bodies embedded in a paler lilac coloured material which in the fresh preparations had a gelatinous appearance.

The organism appears to be either a coccus or a very short bacillus about 0·2–0·3 microns in diameter.

(40) Graham (R.) & Himmelberger (L. R.). **The Value of Virulent Salt Solution in the Production of Antihog-cholera Serum by the Intravenous Method.**—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 118–123.

The authors have taken up the work first suggested by Craig and Robbins of attempting to increase the yield of virus from pigs by injecting normal salt solution into the peritoneal cavity and leaving it there for some hours before slaughter. They have however used the virulent salt solution thus obtained for intravenous injection instead of subcutaneous injection.

They have found that the best results are obtained when 25 cc. per pound body weight of 0·9 per cent. salt solution are injected into the peritoneum five or six hours prior to slaughter, the salt solution being withdrawn with aseptic precautions afterwards.

The amount of blood obtained when this plan is adopted is from 10 to 20 per cent. greater than ordinarily, and from 40 to 70 per cent. of the salt solution injected is recovered.

Salt virus and blood virus were first used for hyperimmunisation in mixtures containing respectively 1, 2, and 3 parts of blood to 3, 2, and 1 part of salt virus. The dose of the mixture was 7 cc. per pound weight.

The sera of these three animals proved to be protective.

Subsequently a number of other mixtures were used, but in general the proportion of blood virus to salt virus was 60 to 40, the dose being 7 cc. per pound body weight. The serum obtained by this procedure was efficient for the protection of pigs against 2 cc. of virus.

It is not contended that the salt virus is as virulent as the blood virus, but it is shown that the mixture is effective for the production of serum, and it is suggested that if a higher concentration of salt solution were introduced into the peritoneal cavity a higher degree of virulence would be acquired by it.

On the basis that a virus pig yields about 10 to 15 cc. of blood per pound body weight, the injection of the salt solution into the peritoneum increases the yield by from 200 to 500 cc. Including the blood virus and the salt virus the total yield of virus is increased from 75 to 80 per cent.

(41) Railliet (A.) & Henry (A.). **Le parasite de la dermite granuleuse des equidés.** [The Parasite of Granular Dermatitis in Equines.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 695–704. With 3 text-figs.

The authors deal at some length with the evidence upon which they base the conclusion that the parasite present in summer sores does not belong to the genus Filaria, but to the Spiroptera, and that it should in reality be classed in the genus Habronema.

With regard to the manner in which the embyros gain access to the subcutaneous tissue, the authors are inclined to think that the embryos are passed out from the stomach and reach the exterior with the faeces, and that they penetrate the skin in the same manner as the larvae of the ankylostomes, and that the rubbing due to the irritation thus set up is responsible for the production of the sores.

(42) Carpano (M.). **Sulla virulenza del sangue degli animali infetti di peste bovini.** [The Infectivity of the Blood of Animals infected with Rinderpest.]—*La Clinica Veterinaria.* 1915. Dec. 15. Vol. 38. No. 23. pp. 901–915.

As a result of some observations carried out in Eritrea, the author arrives at the conclusion that the blood in cases of rinderpest may not be infective during the stage of the disease that is characterised by symptoms indicating gastro-intestinal disturbance, nor at the time of death.

(43) Armfield (J. M.). **Some Important Cattle Diseases in North-West Rhodesia not mentioned in Text-Books.**—*Vet. Jl.* 1915. Dec. Vol. 71. No. 486. pp. 583–584.

The author records the occurrence of a disease somewhat resembling three-day sickness, but differing from that disease in that the animals showed stiffness in the hind limbs for many weeks, and became very emaciated ; and also a condition which he terms " posterior paralysis " which has caused losses among imported bulls. The latter disease has only been observed during the last two years. Nothing is known regarding the cause of either of these conditions. In some cases the disease is acute and in others chronic. The author has seen a case terminate fatally in three weeks. Although the disease has been most frequently observed in imported animals, and in cross-breds, cases have also been seen in native animals.

(44) Bevan (Ll. E. W.). **A Simple Method of obtaining Serum for the Agglutination Test from Cattle Suspected to be suffering from Contagious Abortion.**—*Jl. Comp. Path. & Therap.* 1915. Dec. Vol. 28. No. 4. pp. 277–280. With 2 text-figs.

Owing to the difficulties associated with the obtaining of sterile blood under the conditions prevailing on the veldt, a number of tests

were carried out with the object of ascertaining whether any antiseptic mixture could be added to blood to prevent putrefactive changes occurring in it. It was found that a 3 per cent. solution of boracic acid in normal salt solution, when added to the blood in the proportion of one part to five, was quite efficient for this purpose, and that such addition did not render the serum unsuitable for the test.

For the collection of the blood tubes were prepared in the following way :—Pieces of glass tubing three inches long and with a bore of 4 mm. and an external diameter of 6 mm. were drawn out at each end, so that the tapering portions did not exceed one inch in length, and the ends were clean cut. If the tubing was larger than this the capillary attraction was not sufficiently great, and the blood tended to run into the tube and close the opposite end. If the point were too finely tapered the blood tended to coagulate in the point.

In taking the blood the best method was found to be as follows :—

A cut was made on the lower margin of one of the ears, preferably the left, so that the blood flowed too freely to coagulate.

A quantity of the boracic solution was drawn into the pipette the point of which was then applied to the drop of blood on the edge of the ear, the tube being held horizontally.

When the blood has been collected the ends of the tubes are sealed in the flame of a spirit lamp, or if that be not available they may be plugged with sealing wax.

By adopting this method it has been found possible to test every sample sent in to the laboratory, whereas when the blood was withdrawn from the jugular 50 per cent. of the samples had to be rejected owing to contaminations having rendered the blood quite unsuitable for the test.

(45) Boerner (F.) Jr. **Natural Haemolysins in Normal Horse Serum.**—*Jl. Infect. Dis.* 1915. Nov. Vol. 17. No. 3. pp. 497–499.

Conclusions : —

" Of 200 sera examined for antisheep haemolysin, 1·5 per cent. were found capable of producing complete destruction of these cells in the amount of 0·4 cc.

" Horse serum was found to possess the property of dissolving the red cells of the dog without the aid of complement.

" Native haemolysins for the cells of the guinea-pig, hog, goat, cat, white mouse, rabbit, chicken, and man were not found."

(46) Kolmer (J. A.), Trist (M. E.) & Heist (G. D,). **Complement Fixation in Intestinal Parasitism of Dogs.**—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 88–105.

The authors were induced to carry out the investigations described in this paper by the fact that in superficial diseased conditions such as ringworm positive complement fixation tests can be obtained. Dogs were selected on account of the abundance of material available, and the possibility of controlling the results by post-mortem examination.

As antigens extracts in salt solution and alcohol were prepared from various worms that are frequent inhabitants of the intestine of the dog. In addition to these an extract of *Strongylus gigas* was also used.

The salt solution extracts were prepared by grinding up 4 grams of washed parasites with sand and powdered glass and suspending the resulting material in 100 cc. of salt solution containing 0·5 per cent. carbolic acid. The mixture was shaken for 24 hours in a shaker, incubated for several days at 37° C., and then filtered and stored. These extracts were found to be rather variable and to require titration before every experiment, as the anti-complementary units present varied considerably.

The alcoholic extracts were made with absolute alcohol in the same manner, except that the incubation was continued for a longer time.

One of the difficulties encountered in the course of the observations was the frequent occurrence of non-specific complement fixation. The sera were therefore generally used in both the active and inactivated state. The dose was generally about 0·1 cc.

Another difficulty was the impossibility of ascertaining the duration of the infestation, and the difficulty of excluding infestations on the basis of a single or multiple negative examination of the faeces. It is unsettled whether antibodies persist in the body after the expulsion of the parasites.

Tabular statements of the tests carried out with various extracts are given, the results of which are also summarised.

Tests were made with serum from 172 dogs, but in 62 instances proper examination of the faeces could not be carried out.

From these the following information may be gained :—

Of 36 dogs, the sera of 10 gave positive results with salt solution extracts of *Ascaris canis*. The sera of only two of these dogs gave positive results with alcoholic extracts of the same parasite. Positive results were obtained with alcoholic extracts of *Ascaris lumbricoides* in the case of 11 dogs, and of these five had given negative results with the two extracts of *Ascaris canis*.

In five dogs which were infested with *T. serrata* three yielded positive results with the salt solution antigen, and four with the alcoholic extract antigen. None of these reacted to an alcoholic antigen prepared from *T. saginata*, but four dogs infested with *Dipylidium caninum* gave positive results.

Thirty-four dogs infested with *Trichocephalus dispar* were tested with salt solution extracts, but the result was negative in each case. Sufficient parasites were not available for the preparation of an alcoholic extract.

In a considerable number of cases positive results were obtained with sera from dogs in whose faeces no ova could be discovered. The tabular statement of these tests does not include those in which the serum control tube showed an anticomplementary state of the serum.

In a previous paper the authors have shown that inactivating normal rabbit and dog serum by heating to 56° C. for half an hour greatly increases the antilytic activity and the percentage of non-specific complement fixations. But heating to 62° C. tends to remove a large amount of the non-specific antilytic complement fixing substances without materially decreasing the amount of antibody.

In general it appeared that a higher percentage of positive results was obtained when alcoholic extracts were used than when salt solution extracts were employed, and that tapeworms were more likely to give rise to antibodies than round worms. It would further appear that the antibodies are not highly specific.

Experiments in which descending doses of serum were used showed that the tapeworms and the round worms produced antibodies almost specific for themselves, but not highly specific for different worms belonging to these groups.

Very similar results were obtained when rabbits were immunised with extracts of the parasites, and their sera tested with homologous and heterologous antigens.

(47) SARTORY (A.). **Présence du *Sporotrichum beurmanni* de Beurm. et Goug. sur un épi de blé.** [The Presence of *Sporotrichum beurmanni* on an Ear of Corn.]—*C. R. Soc. Biol.* 1915. Dec. 31. Vol. 78. No. 20. pp. 740–742.

The author cultivated the parasite from an ear of corn which was thought to be infected with rust.

Cultures were obtained in the first instance on simple agar and on Sabouraud's peptonised glucose agar. A mycelium composed of segmented filaments 2 microns in diameter developed in a week. Conidia were present along the sides and at the extremities of the filaments and the side branches. The spores were pyriform and attached to the filaments by very slender pedicles. They measured from 3 to 6 microns in length and from 2 to 4 in breadth. When mature they were oval in shape.

The colonies on Sabouraud's medium presented the typical wrinkled appearance on the surface, and gradually changed in colour from white to coffee coloured and then to a brown black.

The parasite was cultivated on glycerinised potato and carrot, the latter acidified with 3 per mille tartaric acid, peptone agar, broth, glucose broth, glucose gelatin, coagulated serum, milk, starch, white of egg, haemoglobin, urea, ammoniacal salts, and peptone water.

There was no transformation of starch into dextrin, no liquefaction of the egg-white, no fermentation of the urea, nor alteration in nitrates and nitrites. Gelatin was liquefied, and there was no formation of indol. Glucose, galactose, levulose, saccharose, and maltose were fermented, but lactose, dulcite, and mannite were not.

Passage of the parasite through the rat exalted its virulence and eventually the organism produced a rapidly fatal septicaemia. Agglutinins and antibodies could be detected in the blood, and positive complement fixation results were obtained.

The author refers to GOUGEROT's discovery of the parasite on plants in the Alps.

(48) MARIN & HENRY. **Le charbon bactéridien dans le region de Constantine.** [Anthrax in the Neighbourhood of Constantine.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 79–81.

In this short paper the authors draw attention to the occurrence of atypical cases of anthrax among bovine animals. In some instances outbreaks of the disease have occurred, but other isolated cases have

been encountered. In some of these cases a diagnosis would not have been made unless microscopic examination had been resorted to on account of the absence of symptoms and the usual lesions. Cases have come under observation in which the spleen was practically normal in size and colour, and in others the blood appeared to be partially coagulated. It was only after the carcase had been skinned that blood-stained exudates were found in the subcutaneous tissue and between the muscles. In two animals the only lesions were haemorrhagic mediastinal glands.

Diagnosis has been established in these cases by microscopic examination and by cultivation.

These facts emphasise the importance of very careful inspection of meat.

The authors have not observed any cases of the disease in animals other than of the bovine species, and the majority of cases have occurred in animals imported from France, or among the progeny of such animals crossed with local breeds. The indigenous cattle are not immune.

In three outbreaks protective serum obtained from the Pasteur Institute at Paris has been used with exceedingly good results. During 1915 vaccination was employed on a large scale and a few cases have been observed among unvaccinated animals only.

In no case has the vaccination been responsible for death.

(49) Conreur (Charles). **Cachexia ossea dos equideos—Cachexia verminosa dos equideos—Cylicostomose. (Vulgarmente, no Brasil: Cara inchada).** [Osseous Cachexia of Horses—Verminous Cachexia of Horses—Cylicostomosis. Vulgarly called in Brazil, Swollen Face.]—*Arch. Brasileiros de Med.* 1915. Aug. Vol. 5. No. 8. pp. 323–348.

By the above names the author distinguishes a disease of horses which is in his opinion due to the presence of the intestinal worm, *Cylicostomum tetracanthum*. It occurs throughout Brazil from north to south, where it chiefly affects young horses imported from Europe, especially thoroughbreds. It has been already described by Germain, Carougeau and others as occurring in Tonkin, Madagascar and other tropical localities, and its presence in Brazil was first noted by Lutz in 1910. [The author gives no references to the literature of the subject.]

The author having had the opportunity of making numerous post-mortems on horses dead of this disease has found in all of them the intestinal worm already mentioned, and therefore attributes the symptoms to its presence. The disease is common in racing stables near Rio de Janeiro, where young imported thoroughbreds are trained. The ova of the worm can be found in the faeces, and the manure from these stables is often spread on grass land, which is then mowed for hay or green fodder. The disease is thus propagated. The animals present a gradually increasing cachexia followed by fragility of the bones, which results in numerous spontaneous fractures necessitating slaughter. In the final stages the maxillary bones are attacked by a rarifying osteoporosis, accompanied by swelling, to which the vulgar name of "Swollen face" is applied. The author scouts the idea that

this cachexia is in any way due to malnutrition, or to deficiency of lime in the soil, because cattle and sheep pastured on the same ground are totally exempt from the disease, and moreover do not present signs of rickets.

Regarding the disease as due to the action of a toxin on the haemopoietic system, the author recommends the internal use of arsenical preparations, and accordingly, has tried cacodylate of sodium, arrhenal, atoxyl and salvarsan in doses ranging from 60 to 120 centigrammes given intravenously two or three times a week, for from four to eight consecutive weeks. As a vermifuge, the author recommends for young horses from one to two years old the following bolus:—

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| Thymol .. .. .. .. | 6 grammes. |
| Santonin .. .. .. | 50 centigrammes. |
| Aloes .. .. .. .. | 6 grammes. |

Hard soap, sufficient to form a bolus.

S. One to be given every two to four days.

For a horse from two to three years of age, the dose should be increased by 50 per cent., and for one over three years, by 100 per cent. The dose should be repeated till three or four have been given.

The author believes that he has obtained excellent results from this treatment with horses in the early stages of the malady, some of them having been able to win races within two months of the cessation of treatment. As a preventative, the burning of all manure from infected horses, or its burial in cultivated soil, is advised, instead of allowing it to be spread on grass land.*

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## REPORTS.

(50) PUNJAB. **Annual Report of the Camel Specialist.** [CROSS (H. E.).] 21 pp. 1915. Lahore: Superintendent, Government Printing. [Price 2*d.*]

In connection with the question as to whether other animals are susceptible to camel surra only a small number of experiments could be carried out, on account of pressure of other work. The results appeared to indicate that dogs are susceptible, but goats insusceptible. One experiment was carried out in which the camel strain was passed through a pony and then again inoculated into a camel. This single result appeared to indicate that passage through a pony attenuates the virus for the camel.

Treatment.—Sixty-eight animals were treated by the "arsenic alone" method or by the "arsenic and soamin" method. Of these 54 were reported as cured and 14 died.

Experiments in the treatment of the disease have been or are being carried out. Iodine, carbolic acid, sodium bicarbonate, potassium permanganate and borax have been tried, but no good results have been obtained with any of them.

With a view to protecting camels from the bites of blood-sucking flies a number of investigations were made into the properties possessed by various substances for this purpose.

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* Summarised by Dr. J. B. NIAS.

The conclusion arrived at was that the only emulsion that was of any use was one of chirpine oil in the proportion of 20 to 40 ounces to a gallon of water. The amount sprayed on each camel should be about four pints. Even this emulsion was not of any great value from a practical point of view as it was efficient for only about three hours. If the emulsion was made with 80 ounces of the oil to two gallons it was found that blistering of the skin resulted.

Inspection of castrated camels indicated that those castrated at seven years and upwards were much better animals than those operated upon earlier.

Experiments showed that the best purgative for camels is magnesium sulphate, the dose being from 1½ to 2 pounds. Next in order with the doses are: Kamala, 8 ozs.; croton oil, 3½ drachms; aloes, 3½ ozs. of solution; gamboge, 3 ozs.; and linseed oil, 4 pints. Two grain doses of eserine and pilocarpine given subcutaneously give satisfactory results.

(51) Gold Coast. **Annual Report of the Veterinary Department.** 1914. [Beal (W. P. B.).] 18 pp. With a map, 3 plates & 1 chart. 1915. London: Waterlow & Sons, Ltd.

Trypanosomiasis.—The disease caused in equines by *T. cazalboui* is less serious than that due to *T. pecaudi*. In many cases of infection by the former parasite there are no clinical symptoms save dullness and elevation of temperature. In the disease produced by *T. pecaudi* there is swelling along the belly and oedema of the sheath and testicles. Filling of the legs and enlargement of the submaxillary glands are more marked in cases of *pecaudi* infection.

In the case of cattle similar effects are seen, the *cazalboui* infection being far less severe than the infection with *T. pecaudi*. It is said that cattle under good conditions infected with the former parasite may show no evidence of ill health.

Beal has come to the conclusion that *T. nanum* is identical with the trypanosome which he refers to as *T. cazalboui*.

## RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 4, pp. 163–164.]

### Leishmaniasis.

(52) ARAVANDINOS (A.). Contribution à l'historique de la leishmaniose interne. [The History of Internal Leishmaniasis.] —*Bull. Soc. Path. Exot.*, 1916. Jan. Vol. 9. No. 1, pp. 10–13.

(53) LOW (G. C.). A Case of Oriental Sore treated by Antimonium tartaratum (Tartar Emetic) locally.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 258–260.

### Spirochaetosis.

(54) LURIE (G. A.). Notes on Castellani's "Broncho-Spirochaetosis," with Report of a Case.—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 1. Vol. 18. No. 23, pp. 269–271. With 1 text-fig.

### Trypanosomiasis.

(55) GREGGIO Rd. S. J. (P. G.). La Trypanose humaine et la Natalité infantile dans la région de Kisantu (Moyen Congo Belge.).—Influence du traitement atoxylé. [Human Trypanosomiasis and the Birth-rate in the Kisantu District, Middle Belgian Congo.—The Effects of the Atoxyl Treatment].—*Bull. Soc. Path. Exot.*, 1915. Dec. Vol. 8. No. 10, pp. 752–764.

### Biting Flies and Ticks.

(56) BISHOPP (F. C.). Flies which cause Myiasis in Man and Animals —Some Aspects of the Problem.— *Jl. Econom. Entomol.*, 1915. June. Vol. 8. No. 3, pp. 317–329.

(57) CHIDESTER (F. E.). Sarcophagid Larvae from the Painted Turtle.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 48–49. With 2 text-figs.

(58) CHRISTOPHERS (S. R.). The Pilotaxy of Anopheles.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 362–370. With 1 plate.

(59) CHRISTOPHERS (S. R.). The Male Genitalia of Anopheles.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 371–394. With 6 plates comprising 36 figs.

(60) EDWARDS (F. W.). Eight New Mosquitos in the British Museum Collection.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 357–364. With 5 text-figs.

(61) KNAB (F.). Some New Neotropical Simuliidae.—*Bull. Entom. Research.* 1915. Dec. Vol. 6. No. 3, pp. 279–282.

(62) LAMBORN (W. A.). Second Report on Glossina Investigations in Nyasaland.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 249–265. With 3 plates comprising 6 figs.

(63) LLOYD (Ll.). On the Association of Warthog and the Nkufu Tick (*Ornithodorus moubata*).—*Ann. Trop. Med. & Parasit*, 1915. Dec. 30. Vol. 9. No. 4, pp. 559–560.

(64) MACFIE (J. W. Scott). Observations on the Bionomics of *Stegomyia fasciata*.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 205–229.

(65) RICARDO (Gertrude). Two new Species of Haematopota from the Federated Malay States.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 403–404.

(66) Ricardo (Gertrude). Notes on a Collection of Tabanidae from Hong Kong.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 405–407.

(67) Schwetz (J.). Preliminary Note on the General Distribution of *Glossina palpalis*, Rob-Desv., in the District of Lomami, Belgian Congo.—*Ann. Trop. Med. & Parasit*, 1915. Dec. 30. Vol. 9. No. 4, pp. 513–526. With 1 map.

(68) Schwetz (J.). Quelques observations préliminaires sur les moeurs de la *Glossina brevipalpis*. [Some Preliminary Observations on the Habits of *Glossina brevipalpis*.]—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 289–292. With 1 map.

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